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INSTRUCTION MANUAL

FREQUENCY SELECTIVE

VOLTMETER

MODEL 125A

PHILCO Ford

PHILCO-FORD CORPORATION
Sierra Electronic Operation
Menlo Park, Calif. • 94025

FREQUENCY SELECTIVE VOLTMETER MODEL 125A

101 and Up

A02512500A Price $10.00

March 1968

Errata Sheet for Sierra Model 125A Frequency Selective Voltmeter

Page 1, Paragraph 2
Poor printing of word "exceptional"

Page 1, Paragraph 5
Delete suffix "s" from "strays"

Page 2, Paragraph 2
Drawing Number "E-12525-5" in lieu of "E-12525-4"

Page 4, Paragraph 2.3
"V_2" in lieu of "V_3"
"S_3C_1" in lieu of "S_3c,"
"S_3d_1" in lieu of "S_3d"

Page 5, Paragraph 2.6
"Crystal" in lieu of "crystal"
"attenuation" in lieu of "attenuator"

Page 6, Paragraph 2.9
Line 8 -- "millivolt" not "millivolts"

Page 8, Paragraph 3.2.1
Line 6 -- Change from "The variation is" to "The variation of"
Line 7 -- Change "sensitive" to "sensitivity"

Page 12, Paragraph 2
Line 2 -- Change "wil" to "will"

Page 16, Paragraph 1
Change sentence from "The informations given..." to "The information given below permits the performance of a calibration equivalent to factory standards."

Page 17, Paragraph 5.3
Delete the minus sign used on voltage measurement 6.3 vac secondary

Page 24, Paragraph 5.11.1
Change "190" to "1%"

Page 29, Paragraph 5.15.1.1
(a) -- Change "leve" to "level"
(b) -- Change "-200Kc" to "200Kc"

Page 30, Paragraph 5.16
Line 5 -- Add the word "a" after "is"

Page 32, Paragraph 6.1A, Paragraph 4
The word "this" is printed and spaced poorly

Page 33, Paragraph 6.1.2, Paragraph 2
Line 8 -- Change "alter" to "altering"
Change "a" to "an"
Change "components" to "component"

Page 34, Paragraph 6.1.2
Change "hold always" to "Always hold"

Page 35, Paragraph 6.2
Add "s" to "characteristic"

Page 37, Paragraph 2
Poor printing of the word "coupling"

Page 38, Paragraph (c)
Change "rear" to "gear"

Page 39, Paragraph 6.3.1.2
The paragraph number and the word "electrical" have a line through them
Change "bayonnet" to "bayonet"

Page 41, Paragraph 5
Line 5 -- Change "develope" to "develop"
Line 9 -- Change "uncrew" to "unscrew"
Line 13 -- Change "to locate" to "location of"

Page 42, Paragraph 6.3.2.2
Line 6 -- Change "previous" to "previously"
Line 10 -- Delete the word "a"
Line 11 -- add "s" to "plier"

Page 44, Paragraph 6.4.1
Sub-Paragraph 2 -- Change "binder" to "binding"
Sub-Paragraph 3 -- Delete words "and accurate"
Paragraph 6.4.2, NOTE -- Change "have" to "has"

Page 55, Paragraph 6.9.2
Change "a plier" to "pliers"

Page (d)
Change "significent" to "significant"

SIERRA ELECTRONIC CORPORATION
Division of Philco Corporation
Menlo Park, California

RETROFIT KIT

The Retrofit Kit is intended for all Frequency Selective Voltmeter, Model 125A, having a serial number below No. 621.

The kit consists of the following parts:

Two (2) RESISTORS, 27 Ohms ± 5%, 1.0 Watt.
One (1) TERMINAL STRIP, two terminals, Sierra Stock No. 919100018 or SP-258-1-18.

The kit parts are to be mounted and wired as described and illustrated below:

Procedure:

Step 1: Remove the instrument chassis from the cabinet and turn upside down to have access to the power transformer (T3) terminals. Disconnect from T3, terminals 1 and 2, the wiring harness red leads. (See illustration 1)

Step 2: Remove the nut, while holding in place the mating screw. (See illustration 1).

Step 3: Install the terminal strip provided over the screw and replace the nut (See illustration 2).

Step 4: Mount the resistors (27 ohms) between the power transformer terminal 1 and 2, and the terminal strip. (See illustration 2).

a. One resistor between the transformer terminal 1 and one of the strip terminals.

b. The other resistor between the transformer terminal 2 and the remaining free terminal of the strip.

Step 5: Connect the wiring harness red leads, (previously disconnected in Step 1), to the terminal strip. One lead per terminal.

Instruction Manual Modification

List of Replaceable Parts

Page 62 add:

R116: Resistor, 27 ohms ± 5%, 1.0 watt Fixed Composition
Sierra Stock No. 905400270
Mfg.: AB
Designation: EB

R117: Same as R127

Schematic E-12525-5
Modify as follows:

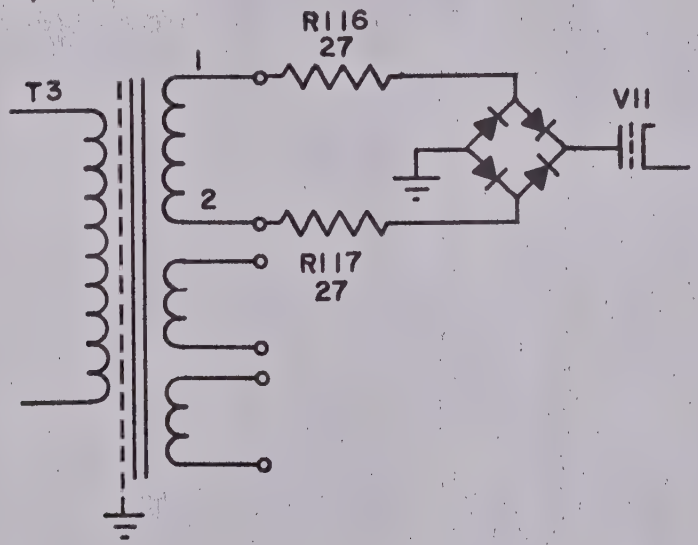




ILLUSTRATION 1

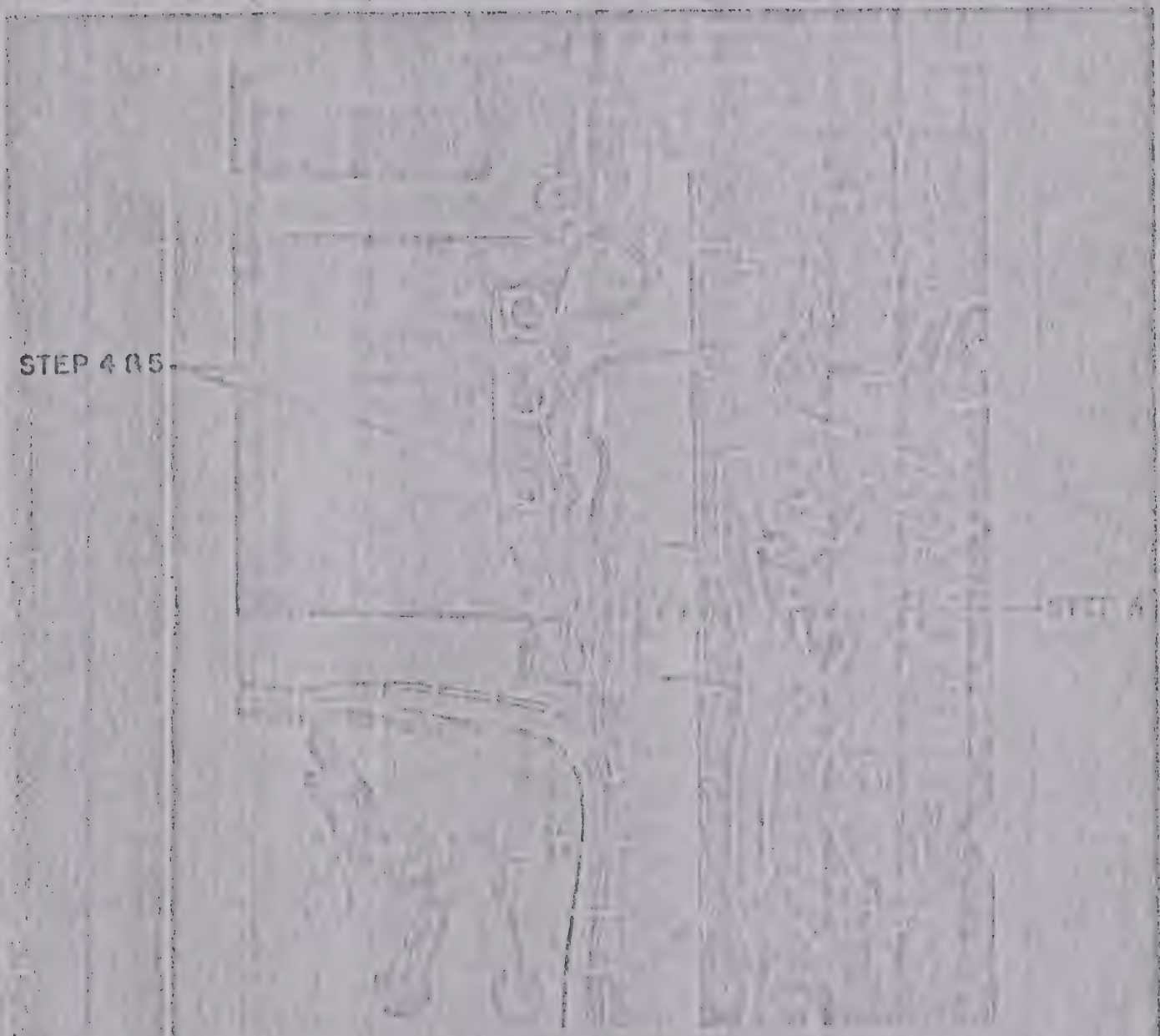
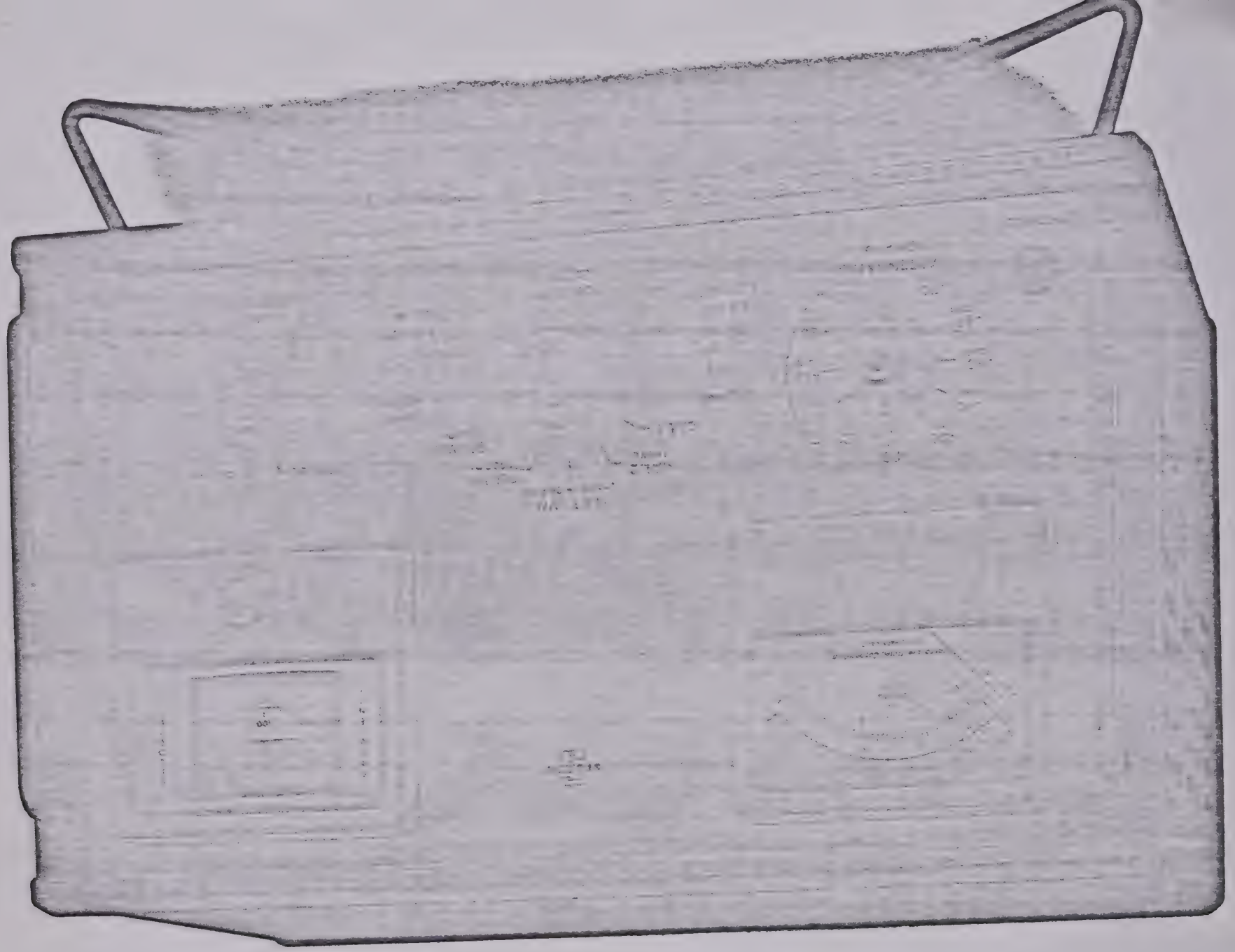


ILLUSTRATION 8



SUMMARY OF TECHNICAL SPECIFICATIONS

FREQUENCY RANGE

Selective Voltmeter	3 kc to 620 kc
Flat Voltmeter	1 kc to 620 kc

INPUT LEVEL RANGE

Selective Voltmeter	-90 dbm to +32 dbm (24.5 microvolts to 30 volts)

MEASUREMENT ACCURACY

Selective Voltmeter	± 1 db for all levels
Flat Voltmeter	± 0.5 db for all levels

SELECTIVITY (2 Bandwidths and Flat Voltmeter)

Wide Band (2500 cps)

a.	3 db down	2500 cps (± 1250 cps)
b.	30 db down	6000 cps (± 3000 cps)
c.	60 db down	14000 cps (± 7000 cps)

Narrow Band (250 cps)

a.	3 db down	250 cps (± 125 cps)
b.	30 db down	600 cps (± 300 cps)
c.	60 db down	1400 cps (± 700 cps)

Flat Voltmeter Response

a.	Flat within ±0.2 db	1 kc to *620 kc
b.	Flat within 3.0 db	300 cps to *750 kc
c.	Response 20 db down . . .	60 cps and *1100 kc

*NOTE: Due to input filter cut-off.

INTERMEDIATE FREQUENCY (IF) . . . . . 2.215 mc

DIRECT READING	
dbm	135 ohm and 600 ohm Balanced or unbalanced
voltage	600 ohm balanced or unbalanced position only
INPUT IMPEDANCE	
600 ohm position	20,000 ohms nominal
135 ohm position	4,500 ohms nominal
Bridging Loss	less than 0.25 db over entire frequency range
FREQUENCY ACCURACY	± 1 kc up to 100 kc ± 2 kc up to 620 kc over temperature range of 50°F to 120°F
SPURIOUS RESPONSE	at least 60 db down
POWER INPUT	105 to 125 volts, 50/60 cps 60 watts
FUSE PROTECTION	1.0 amperes, slow blow
OVERALL DIMENSIONS	
Width	17 inches
Height (retracted stand)	10-1/8 inches
Height (extended stand)	12-3/10 inches
Depth	14-1/4 inches
WEIGHT	30 pounds.

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Bels, Decibels and Nepers.

Color Codes.

Short Form Catalog.

1.0 GENERAL

2.0 DESCRIPTION

3.0 PERFORMANCE



1.0 GENERAL

The Model 125A is a Frequency Selective Voltmeter designed to measure voltages in the frequency range of 1kilocycle to 620 kilocycles. The Model 125A has a high input impedance and is direct reading in dbm when bridged across either a 135 ohm or 600 ohm line.

The flexibility of the Model 125A is greatly enhanced as it provides a choice of two selective bandwidths and in addition a flat voltmeter. This provides exceptional versatility in making measurements on carrier systems including measurements of complex waveform analysis.

The two bandwidths are derived through the use of crystal filters in the intermediate frequency amplifier circuit. They provide selective bandwidths of either 2500 cycles or 250 cycles. The operator selects the bandwidth by placing the Function Selector to the desired position.

The Model 125A covers a measurement sensitivity range of +32 dbm to -90 dbm, which corresponds to a voltage range of 30 volts to 24.5 microvolts. An internal calibration crystal oscillator is incorporated to provide an accurate method of self-calibration.

The Model 125A uses printed circuitry technique to alleviate the variation in strays effects and maintain constant characteristics in all instruments.

Long life and sustained performance are insured by the selection of high temperature components and large derating of these components.

Accuracy and stability over long periods of time and wide ambient temperature variation are maintained by including in this instrument highly regulated d-c supply and stabilized oscillators. Excellent filtering and decoupling of all voltage supplies accompanied by thorough shielding of individual circuits eliminates interferences and spurious generation.

2.0 DESCRIPTION

The basic circuit of the Model 125A e...ploys a single conversion principle, which is most desirable as it results in a minimum of spurious responses. In addition, the circuit incorporates a dual bandwidth feature which provides the use of either broad band measurements together with narrow bandwidth measurements where extra selectivity is required. The flat voltmeter section is very useful in obtaining a broad voltage measurement of the entire system under analysis. This measurement can be used to determine the relative level of the strongest signals in the system.

The front view of the Frequency Selective Voltmeter is shown in Figure 1. A block diagram, shown in Figure 2, is included to provide an understanding of the various sections of the voltmeter. The circuit schematic is shown in Figure 3, Drawing Number E-12525-4.

2.1 Input Circuit

The input circuit consists of three sub-circuits. An input bridging transformer and selector circuit, an input filter and a precision attenuator. A balanced incoming signal enters the bridging circuit at the binding-post terminals, across which is connected the primary of the bridging transformer. Connecting the captive shorting link between terminal G and the lower binding-post terminal grounds one side of the primary for unbalanced inputs. The bridging transformer is connected to a selector switch that performs the dual function of maintaining constant circuit impedance and attenuates the input signal in the proper ratios to enable the instrument to read directly in dbm when bridged across 135 or 600 ohm circuits.

The input signal passes from this input transformer and selector switch through a section which includes an input filter and a variable step attenuator before reaching the grid of the mixer tube circuit. The input filter is provided to suppress all signals above 620 kilocycles. The variable step attenuator reduces the signal arriving at the grid of the mixer stage by known fixed amounts so as to increase the voltage measuring range of the instrument and make possible the measurement of relatively large voltages. The attenuator steps are in 10 db internals covering the range of +30 dbm to -70 dbm.

2.2 Local Oscillator and Mixer

The local oscillator tunes over the frequency range of 2.216 Mc to 2.835 Mc. The oscillator design employs a highly stabilized, temperature compensated Hartley oscillator circuit. The stability has been attained by regulating the plate voltage within a 0.25%, and limiting the effects of filament voltage variation. The filament voltage variation is detrimental by the fact that it modifies the μ of the tube and accordingly the grid to plate capacitance (Miller Effect). That grid-plate capacitance effectively shunts the tuned circuitry and acts as a fairly large capacitor varying accordingly to the filament voltage. This effect is swamped to a large extent by making the tuned circuit capacitance

as great as possible, the limiting factor being the LC ratio required to cover the frequency range. Also by coupling the tuned circuit and oscillator tube grid by a very small coupling capacitor, it sets the grid-plate capacitance in series with a small capacitance. That small value of coupling capacitance limits at the same type the effects of grid-cathode capacitance.

2.2.1 The Oscillator Specifications are listed below:

Frequency Range	2.216 mc to 2.815 mc
Type of Circuit	Hartley
Temperature Stability	less than 8 ppm/°C change over the ambient temp. range +10°C to +55°C
Line Voltage Stability	less than 2 ppm/ % for line voltage variation of 105 to 125 volts
Warm-up Stability	frequency stabilized to within 20 cps in 15 minutes

2.2.2 Circuit Description

The output frequency from the local oscillator and the signal from the input attenuator are mixed in the mixer circuit associated with vacuum tube V1. This mixer circuit is a semi or hybrid type of balanced modulator. The circuit is designed to balance out the local oscillator frequency as it approaches the IF frequency, 2.215 mc, thus allowing the input frequency range of the Model 125A to extend down to 3 kc from the IF frequency. Therefore, a good balance of the local oscillator signal is necessary. A sharp crystal filter IF also improves the ability to reach the 3 kc limit.

The output of the local oscillator is fed to a cathode follower, V10B, for isolation and thence coupled,through a balanced transformer, to the modulator diodes. The modulator diodes switch at the local oscillator frequency causing the incoming signal to be modulated in the mixer stage (V1).

The composite signal produced in this stage includes the input frequency, the upper and lower sidebands of the input and local oscillator frequencies together with other higher order products. The local oscillator frequency itself is essentially balanced out in the modulator circuit so as to be down approximately 30 to 50 db. The plate tank circuit of the mixer stage is tuned to the lower side band frequency (IF=2.215mc), and coupled to the cathode follower V2.

2.2.3 Tuning Dial

The local oscillator tuning dial is located on the front panel of the instrument and is calibrated in kilocycles. The tuning knob is located below the dial and is linked by a friction drive to the main dial drum assembly. The drum assembly is coupled directly to the main tuning condenser through one set of anti-blacklash gears, which rotates the condenser in unison with the frequency calibrated drum. The tuned frequency is identified by a scanning light beam which serves simultaneously as a "On" pilot light for the instrument.

2.2.3.1 Fine and Coarse Drive

The tuning control knob can be coupled to the main drum assembly with one of two drive ratios for coarse and fine drive. Pulling the knob out, engages the drive, while pushing the knob in changes the drive ratio to a very smooth fine tuning drive.

2.3 Crystal Filters

The output of the cathode follower V3 is capacity coupled through the S3 c, section of the Function switch and a series matching resistor to the desired crystal filter. The crystal filters require matched load and source impedance of approximate 3900 ohms. The filters designed are for 2.215 mc and therefore control the IF band-pass characteristic. The output of the crystal filter is terminated in a resistive 6 db "T" pad network together with S3d, of the function switch thus providing the proper match. One "T" pad is provided with a trimmer, allowing to equalize the filters insertion losses. The output of the network is applied to the grid of the first intermediate frequency amplifier.

2.4 Intermediate Frequency Amplifier (IF)

The IF amplifier consists of two RC coupled pentode stages, designed with single tuned grid circuit for improved temperature gain stability characteristic. The output from the crystal filter and its termination network is applied to the grid of V3. The 2.215 mc intermediate frequency is applied and coupled to the single tuned circuit at the grid of V4. The signal is further amplified and passes through the second tuned circuit in the output of V4. The IF gain control is provided in the cathode of V4 to give a control range of approximately +5 db above nominal gain to -7 db below. The approximate gain of the Intermediate Frequency Amplifier section is 45 db. The overall gain of the instrument between the input of the mixer stage V1 to the output of V4 is 60 db.

2.5 Flat Voltmeter

The flat voltmeter section is composed of three RC coupled pentode stages constituting a wideband amplifier circuit associated with an output meter. The amplifier has a gain of about 35 db and incorporates approximately 20 db of feedback over all stages

to provide gain stability. The variation in the output meter reading is less than 0.1 db with changes in line voltage of ± 10% and less than 0.1 db with variations in tube GM up to 25%. The frequency response of the flat voltmeter section is designed to be flat to within ±0.2 db over the frequency range of 1.0 kilocycle to 620 kilocycle and within 1 db up to 2.215 mc. The amplifier response is controlled to fall off smoothly to -20 db down at 100 cycles and -10 db down at 10 megacycles.

The output of the last IF stage V4 is carried through S3b to the grid of V5, the input of the flat voltmeter. The output of this stage is capacity coupled to the grid of V6 through a smaller capacitor (C36) which, together with the grid resistor (R62) of V8 provides a smooth fall-off in the response of the meter at low frequencies below 1.0 kilocycles. The signal is further amplified in V6 and capacity coupled to V7. The output of the three-stage amplifier is applied to a full-wave rectifier circuit actuating a 1.0 milliampere meter movement. The rectifier meter circuit is arranged in a bridge type of configuration, with a crystal diode and a capacitor in each branch and the 1.0 milliammeter connected across its midpoints. The diode connection provides fullwave rectification of the input current applied to the circuit. The d-c current through the meter is proportional to the average value of the waveform of the voltage applied to the rectifier circuit. The meter movement thereby responds to the average value of the waveform and is calibrated in the RMS value of a sine wave. The meter shunt capacitor C92 integrates the a-c components.

2.6 Flat Voltmeter or Selective Voltmeter

The output from the input attenuator can be applied to either the mixer stage V1, or to the first stage of the flat voltmeter. This is accomplished by placing the "Function" Selector Switch, S3 in the 2500 cps SV, 250 cps SV position or the Flat Voltmeter position. In the two selective voltmeter positions the signal is applied to the mixer stage, appropriate cyrstal filter, the IF amplifier and thence to the flat voltmeter. In the Flat Voltmeter position of the Function selector switch S3A applies the signal at the top of the last deck in the attenuator directly to the flat voltmeter, thereby cutting out 60 db of attenuator in place of the 60 db of IF gain. This maintains the calibration of the attenuator dial and allows the instrument to be used as a standard flat voltmeter for type of measurements where the selective feature is not required.

2.7 Injection Oscillator

Included in the voltmeter is an injection oscillator to be used as an internal source of voltage and frequency for self-calibration. The oscillator is a modified pierce circuit, crystal controlled and operates at 100 kc with a tolerance of ± .02% over the temperature range of 10°C to 55°C. This oscillator provides a fixed, temperature compensated, amplitude signal which can be switched to the input circuit and act as a substitute for the incoming signal for calibration purposes. When the "Function" switch is placed in the CAL 1 or CAL 2 position, the input filter of the voltmeter is switched to the output of the injection oscillator. At the same time plate voltage is applied to the injection oscillator circuit.

In the CAL 1 position, the injection oscillator signal is carried through the input filter, attenuator to S3a, by-passing the selective voltmeter section of the voltmeter and going directly to the input of the flat voltmeter. The flat voltmeter section is regarded as the standard calibrating device in the instrument because of its inherent accuracy and stability. The injection oscillator level should read approximately 0 dbm in the CAL 1 position. When the "Function" selector is placed in the CAL 2 position, the signal is applied to the selective portion of the voltmeter and the dial is tuned to 100 kc. The CAL 2 IF gain control is adjusted to give a meter reading of exactly the same level as that measured when the "Function" switch was in the CAL 1 position. This should be approximately 0 dbm. This provides an accurate method of calibration of the instrument.

The injection oscillator also produces harmonic output. These harmonics are at 200 kc, 300 kc, 400 kc, 500 kc and 600 kc and will be accurate to the tolerance of the crystal, ± .02%. This allows a convenient method for checking the dial calibration of the instrument at these harmonic frequencies. The voltage level of these harmonics are not to be used for voltage calibration, and are low enough to avoid altering the RF voltage accuracy of the fundamental frequency.

2.8 Audio Output

A phone jack is provided on the front panel for a headset to listen to the incoming signals. The headset is energized from the audio output amplifier stage located on the Flat Voltmeter printed circuit board. The IF signal is coupled from the plate circuit of V7 through a high pass filter circuit to the audio detector CR3 and the audio gain control R82. The audio gain control adjusts the audio output level by controlling the audio level applied to the amplifier-cathode circuit V8. Either high or low impedance phones may be used to monitor the audio.

2.9 Regulated Power Supply

The regulated power supply is designed to deliver a positive d-c voltage of 225 volts at a current of 70 ma. The actual circuit requirements do not exceed 52 ma at 225V. The circuit consists of a single phase full wave bridge rectifier configuration using four silicon diodes. The d-c output regulation is insured by a twin triode cascade amplifier V12 and a true voltage reference tube V13. This type of circuit is capable of the greatest gain among the single envelope d-c amplifier. This circuit provides a regulation better than 0.25% with a line voltage change of 105 to 125 volts. The supply ripple amplitude is less than 1 millivolts. An adjustment (R 113) is provided for setting the output of the supply at its nominal voltage of 225V. The voltage reference being in the grid circuit, there is no loading of the reference source. D-C drift due to changes in V12 filament voltage is cancelled by differential action between the two sections of V12. Transient protection is provided by an RC network located across the power transformer primary winding.

2.10 Input Power Requirements

The Model 125A is designed to operate from a main supply of 117 volts, 50/60 cycles. The voltmeter will operate satisfactorily with a variation in line voltage of 105 volts to 125 volts. The off-on switch is combined with the audio gain control; turn clockwise for the "On" position. The power drain is approximately 60 watts.

2.10.1 Dimensions and Weight

The overall dimensions of the unit are: 14-3/8 inches deep by 17 inches wide. The height of the unit with the stand down is 12 inches. The weight is approximately 30 pounds.

3.0 PERFORMANCE

3.1 Sensitivity

3.1.1 The Model 125A, operating as a selective voltmeter, is capable of measuring voltages equivalent to -80 dbm to + 32 dbm; 77.5 microvolts to 30 volts, respectively across 600 ohms using the upper portion of the decidels meter scale between -10 db and +2 db.

3.1.2 The Model 125A, operating as flat voltmeter, is capable of measuring voltages equivalent to -20 dbm to +32 dbm; 77.5 millivolts to 30 volts, respectively across 600 ohms using the upper position of the decibels meter scale between -10 db and +2 db.

3.2 Accuracy

3.2.1 Operating as a selective voltmeter, the Model 125A, has an overall accuracy of ±10% of full scale as measured on the voltage scale, or ± 1 db on the db scale, over the entire frequency range of 3 kilocycles to 620 kilocycles. The meter linearity is held to ±2% of full scale. The accuracy of any attenuator step is held to within ±0.3 db at any frequency over the entire frequency range. The variation is voltmeter sensitivity vs frequency is less than ±0.4 db. A typical sensitive vs frequency curve is shown on Figure 4.

3.2.2 Operating as a flat voltmeter, the instrument has an overall accuracy of ±5% of full scale as measured on the voltage scale, or ±0.5 db on the db scale, over the entire frequency range of 1 kilocycle to 620 kilocycle. The attenuator accuracy is the same as for selective operation. The variation in sensitivity vs frequency is less than ±0.2 db over the frequency range. A typical sensitivity vs frequency curve is shown on Figure 5.

3.3 Frequency Calibration

The tuning dial calibration is adjusted at the factory to be within ± 1 kc up to 100 kilocycles and ± 2 kc up to 620 kilocycles in an ambient temperature 50°F to 120°F. The dial accuracy is held within ± 1 kc over the entire frequency range at 68°F room temperature.

3.4 Selectivity

The Model 125A incorporates a dual selectivity feature. The narrow bandwidth is 250 cycles while the wide bandwidth is 2500 cycles. The selectivity is as follows:

Narrow Bandwidth:

3 db down . . . . . 250 cps (125 cycles off resonance)
30 db down . . . . . 600 cps (300 cycles off resonance)
60 db down . . . . . .1400 cps (700 cycles off resonance)

Wide Bandwidth:

3 db down . . . . . 2500 cps (1250 cycles off resonance)
30 db down . . . . . 6000 cps (3000 cycles off resonance)
60 db down . . . . . .14000 cps (7000 cycles off resonance)

Typical selectivity curves are shown for both bandwidths in Figure 6.

3.5 Spurious Responses

The spurious responses originating within the selective voltmeter are kept to a very low magnitude when the instrument is operated in accordance with the operating instructions given therein. There are various types of spurious responses generally encountered in equipments of this type, and they have been classified and defined in various standards and textbooks related to the radio engineering art. For convenience of the reader, applicable descriptions of some of these categories are given herewith.

3.5.1 Harmonic Distortion

Harmonic distortion is generated when the signal amplitude applied to the grid of a vacuum tube is large enough to cause operation over more than the linear range of the grid-plate characteristic. This non-linearity produces harmonics of the fundamental input signal. These harmonics are then present in the output of the circuit.

3.5.2 Intermodulation Distortion

Intermodulation distortion occurs when two or more signals are applied to a non-linear system. This type of distortion is based on the fact that the same non-linear distortion that causes the production of harmonics of a pure sine-wave also causes intermodulation of two signals with the resulting sum and difference frequencies together with higher order products being present in the output.

3.5.3 Direct IF Response

Direct IF response can take place when a signal is applied to the input terminals at a frequency equal to the intermediate frequency amplifier value used within the equipment, with the main tuning dial not adjusted to a setting which would tune in this frequency.

3.5.4 Image Response

Image response can take place when a signal applied to the input terminals at a frequency that is twice the intermediate frequency above the tuning dial setting.

Representative values of the various types of responses are as follows:

a. Harmonic Distortion:

2nd harmonic	67.5 db down
3rd harmonic	80.0 db down
Higher harmonics	90.0 db down

b. Intermodulation Distortion: (f_1 = 100.0 kc f_2 = 72.5 kc)

$f_1 + f_2$ (172.5 kc)	66 db down
$f_1 - f_2$ (27.5 kc)	66 db down
$2f_1 + f_2$ (272.5 kc)	80 db down
$2f_1 - f_2$ (127.5 kc)	80 db down
$2f_2 + f_1$ (245 kc)	80 db down
$2f_2 - f_1$ (45 kc)	78 db down
Higher Order Products	80 db down

c. Direct IF Response:

2.215 mc	48 db to 50 db rejection

d. Image Response:

4.430 mc	greater than 60 db rejection

3.6 Input Impedance

The input impedance of the Model 125A is nominally 20,000 ohms on the 600 ohms line impedance input and 4500 ohms on the 135 ohm line impedance input. This corresponds to a bridging loss of approximately -0.14 db. The bridging loss is always less than -0.25 db over the entire frequency range of 3 kilocycles to 620 kilocycles. The bridging loss at 1 kilocycle is approximately -0.3 db. A bridging loss of -0.3 db is equivalent to a resistance input impedance of approximately 10,000 ohms. Typical curves of bridging loss vs frequency are shown in Figure 7.

4.0 OPERATING INSTRUCTIONS

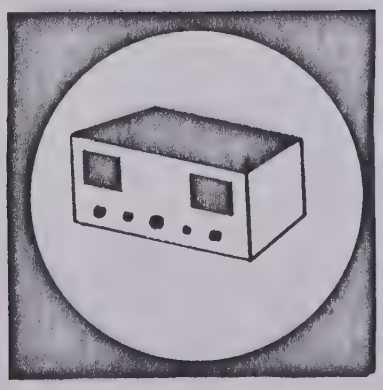
4.1 Calibration - Using Injection Oscillator

4.2 Calibration - Using External Source

4.3 Injection Oscillator Harmonics

4.4 General Measuring Method

4.5 Use of Headset



Preliminary Instructions:

The Model 125A is dispatched with all electron tubes in their holders and with its power input circuit ready for immediate operation from 117 volt, 50/60 cycles supply. The maximum voltage (the sum of the d-c voltages and a-c peak voltage) applied to the input terminals of the instrument must not exceed 400 volts. Higher voltages will break down the capacitor in series with the primary winding of the input bridging transformer.

The scanning light beam of the frequency dial serves simultaneously as a "On" pilot light indicator. Both the ground binding post and the instrument case wil be connected to the power system ground when the instrument is used with the standard NEMA receptacle. Avoid short circuits by connecting only ground potential circuits to the black binding posts. Ground loop may affect the accuracy of low voltage measurements. Open the loop and restore the accuracy by inserting an ungrounded adapter in the instrument power circuit.

4.1 Calibration - Using Injection Oscillator

The injection oscillator is adjusted at the factory to give approximately a zero dbm level on the voltmeter. The frequency accuracy is fixed at 100 kilocycles ±0.02% and is not adjustable. The injection oscillator method of calibration provides calibration accuracy of ± 1 db for the over-all frequency range of the instrument. If greater accuracy is desired for a specific frequency, the voltmeter may be calibrated using an external source as described in paragraph 4.2. To use the injection oscillator for calibration, proceed as follows:

4.1.1 Turn voltmeter "On" and allow it to warm up for at least 15 minutes.

4.1.2 Place the Function switch in the CAL 1 position. The output meter should read 0 dbm. If it does not, the 100 kc oscillator output should be adjusted in accordance with Calibration Section, paragraph 5.9.

4.1.3 Place the Function switch to the CAL 2 position and, after setting the attenuator to 0 db, adjust the tuning dial for a maximum response on the output meter at 100 kc. If the meter reading is not 0 dbm, it should be so adjusted by the CAL 2 (IF GAIN) control knob.

4.1.4 The sensitivity is now properly adjusted. Operate the Function switch to the desired position for measurement, Flat Voltmeter, 2500 cycles SV or 250 cycle SV and proceed with measurements.

4.2 Calibration - Using External Source

If it is desired to use an external source for sensitivity calibration, the following typical procedure should be followed:

4.2.1 Set up a test circuit consisting of an oscillator with a 600 ohm output, a 600 ohm attenuator and a 600 ohm termination. A 600 ohm thermocouple set is preferred for the termination, but at the expense of some accuracy, a 600 ohm resistance and vacuum tube voltmeter can be used.

4.2.2 At the desired calibration frequency, establish a power of 0 dbm (0.775 volts across the terminating resistance) in the termination.

4.2.3 Connect the voltmeter binding post to the 600 ohm termination. Set the Impedance selector to the 600 ohm position and the Function switch to the 2500 cycle SV or 250 cycle SV position. Do not make any adjustment of the external circuit after the Model 125A is connected to the termination.

4.2.4 With the attenuator switch in the 0 db position, adjust the tuning dial for a maximum reading on the output meter and adjust CAL 2 (IF GAIN) control for a 0 dbm meter reading. It is desired to externally calibrate the voltmeter for measurements of 135 ohm circuits, the above procedure may be followed using a 135 ohm test circuit with a power of 0 dbm (0.367 volts) and with the Impedance selector set to the 135 ohm position.

4.3 Injection Oscillator Harmonics

The internal calibration voltage is selected from a portion of the injection oscillator circuit which contains some degree of harmonic content in order to produce output meter deflections when the tuning dial is tuned to the harmonics of the 100 kc signal; 200 kc, 300 kc, 400 kc, 500 kc and 600 kc. This feature is provided for a quick and accurate check of the tuning dial calibration. However, use only the 100 kc dial setting for internal sensitivity calibration purposes since the harmonic voltage amplitudes are less than 100 kc amplitude and cannot be controlled to any great accuracy.

4.4 General Measuring Method

4.4.1 Calibrate the Model 125A as described above using the injection oscillator or an external source as desired.

4.4.2 Set the Function selector switch to the proper position for the measurement to be made and connect the Model 125A to the circuit to be measured. For measurement of unbalanced circuits place the shorting link between the lower insulating binding post and the noninsulated or ground binding post. The grounded side of the circuit under test should be connected to the grounded binding post. For measurements on balanced circuits disconnect the shorting link.

4.4.3 Adjust the tuning dial for a maximum meter reading at the frequency of the signal under measurement, setting the attenuator switch as required to obtain a reasonable on-scale reading.

4.4.4 To obtain the magnitude of the signal in dbm, add the reading of the attenuator algebraically to the meter reading.

4.5 Use of Headset

Headsets equipped with either single-plug type connectors or dual-type connectors may be used for listening to the incoming signals by plugging into the phone jack. The headsets will respond properly when operating the Model 125A on the 2500 cycle SV bandwidth only. The audio level is adjustable from the control knob labeled "Audio Gain". The headset can be either a high or low impedance type as the headset is fed by a low impedance cathode follower output.

5.0 CALIBRATION SECTION

5.1 Preliminary resistance check to ground.

5.2 Power supply adjustment.

5.3 Preliminary voltage check.

5.4 Input circuit check.

5.5 Flat voltmeter adjustment.

5.6 Mixer and IF amplifier tuning.

5.7 Local oscillator alignment.

5.8 Modulator adjustment.

5.9 Injection oscillator adjustment.

5.10 Mixer and IF amplifier tuning....IF gain control range.

5.11 Bandwidth characteristic.

5.12 Bandwidth levels.

5.13 Attenuator check

5.14 Selective voltmeter frequency response.

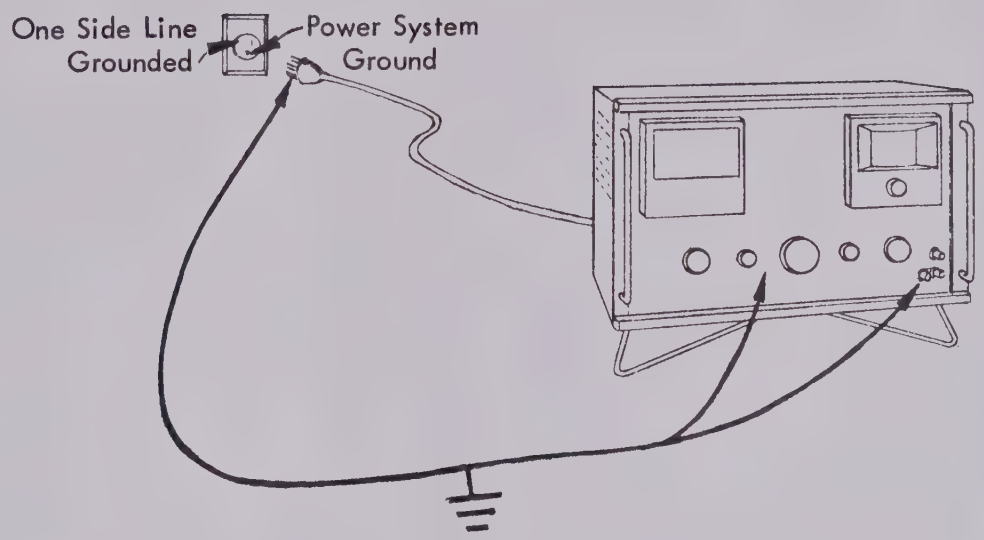
5.15 Harmonic generation and intermodulation.

5.16 Noise level.



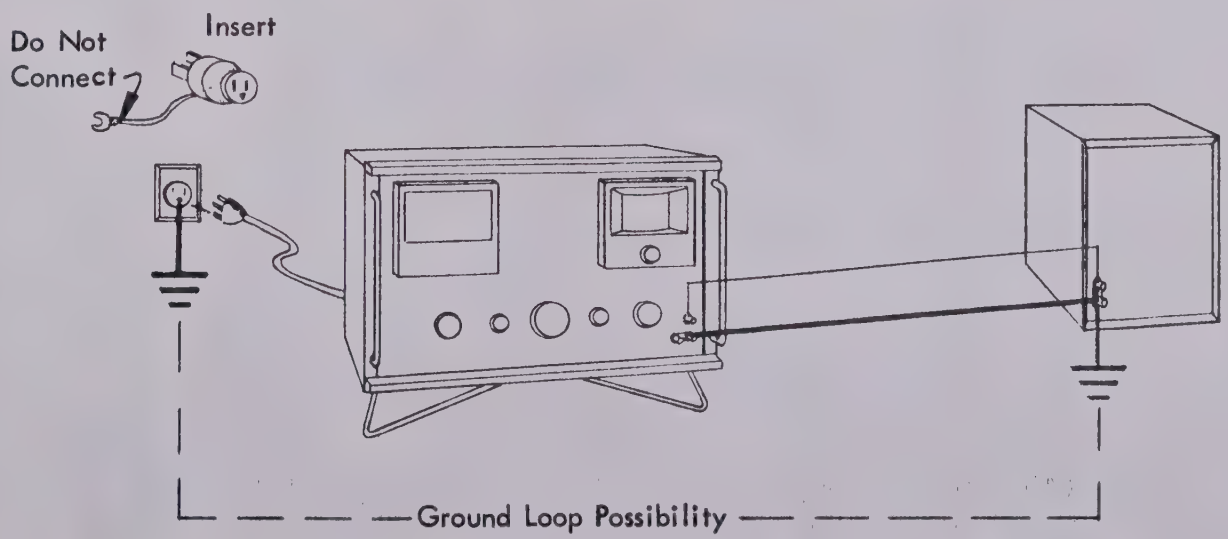
CAUTION

Both the grounding binding post and the instrument case will be connected to the power system ground when the instrument is used with the NEMA receptacle. To avoid short circuit connect only ground potential circuits to the ground binding post.



GROUND LOOPS

Ground loops may affect the accuracy of low level measurements. Open the loop and restore the accuracy by inserting an ungrounded adapter in the instrument power circuit.



GENERAL:

The following independent tests and adjustments can be made at any time. If an instrument is undergoing a complete test procedure, these tests and adjustments are performed in the sequence given in this section. The informations given allow to perform a calibration equivalent to factory standards.

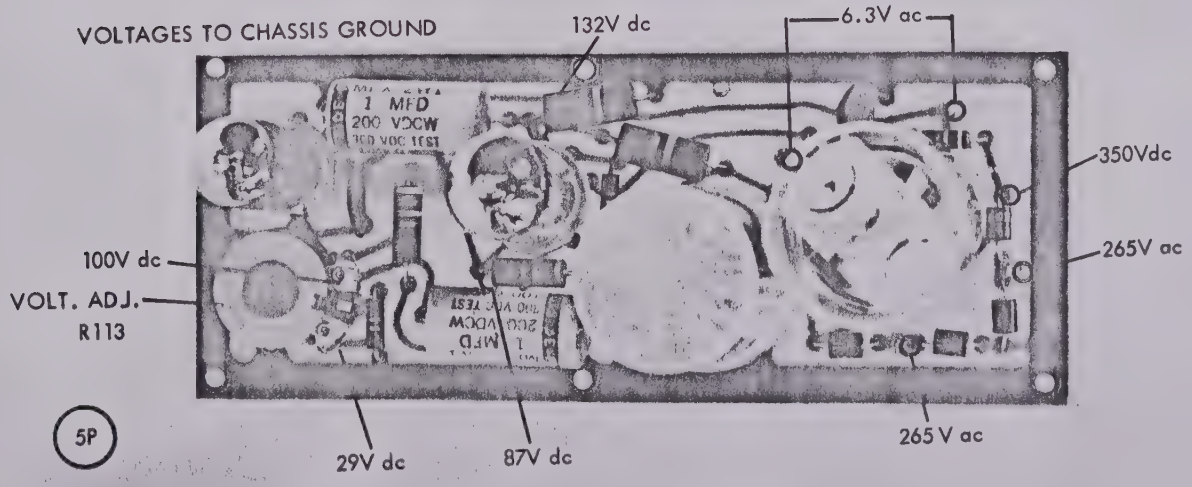
5.1 Preliminary Resistance Check

Before attempting to plug the instrument on the power line, check the following test point resistance to chassis ground, using an ohmmeter such as Weston Model 980, or any 20,000 ohms per volt instrument.

TEST POINT	RESISTANCE*
T3 - Terminal 7 & 8	0-100 K
Pow. Supply - TP1	Approx. 30k
Pow. Supply - TP2-3	Approx. 30k
Local Oscil. - TP29	Approx. 30k
Local Oscil. - TP31	4700 ohms
Flat Voltm. - TP21	2000 ohms
Flat Voltm. - TP22	∞
Flat Voltm. - TP24	Approx. 30k
Flat Voltm. - TP25	Approx. 30k
Flat Voltm. - TP26	Approx. 30k
Flat Voltm. - TP28	∞

* To chassis ground

5.2 Power Supply Adjustment



Connect an accurate d-c voltmeter such as Hewlett-Packard 410B from TP1 to chassis ground and adjust potentiometer R113 for 225 volts. Vary the line voltage from 105 to 125 volts. There should be no variation of the voltage at TP1.

Disconnect the d-c voltmeter and connect instead an a-c voltmeter such as Hewlett-Packard 400C to measure the B+ripple and noise voltage. This voltage should not exceed 1MV rms, with line voltage varying from 105 to 125 volts.

NOTE: If the supply does not operate properly, refer to the maintenance section paragraph 6.3, for full details.

5.3 Preliminary Voltage Check

Before proceeding and to facilitate the detection of trouble check the voltages at the following points.

TEST POINT	VOLTAGE *
Power Supply TP1	225Vdc
T3 Terminal 3 to 4	-6.3Vac **
T3 Terminal 5	6.3Vac
Local Oscil. TP29	225Vdc
Local Oscil. TP30	6.3Vac
Flat Voltm. TP23	6.3Vac
Flat Voltm. TP24	225Vdc
Flat Voltm. TP25	150Vdc
Flat Voltm. TP26	150Vdc
IF Ampl. TP14	225Vdc
IF Ampl. TP19	225Vdc
IF Ampl. TP12	6.3Vac
IF Ampl. TP17	6.3Vac
Mixer TP 4	225Vdc
Mixer TP 5	6.3Vac
Inj. Osc. TP10	225Vdc
Inj. Osc. TP11	6.3Vac

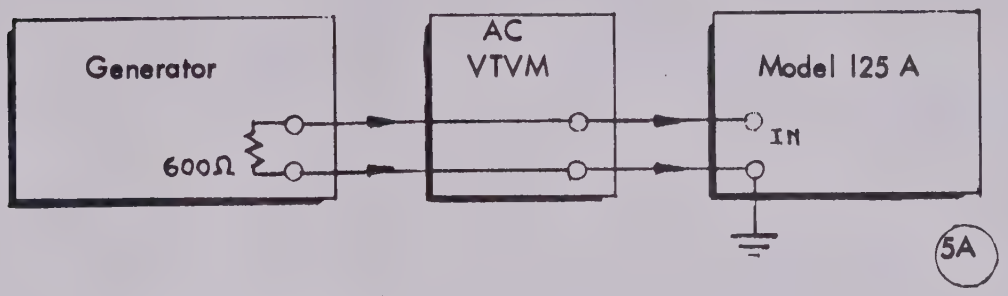
*To chassis ground using a high impedance voltmeter

**In no case to ground

5.4 Input Circuit Check

The input circuit is composed of the bridging transformer, associated input selector, band-pass filter and attenuator switch.

Test set-up: Signal generator, such as Hewlett-Packard 650A. High frequency, 1% accuray, a-c voltmeter such as Hewlett-Packard 400L. Short, shielded interconnections.

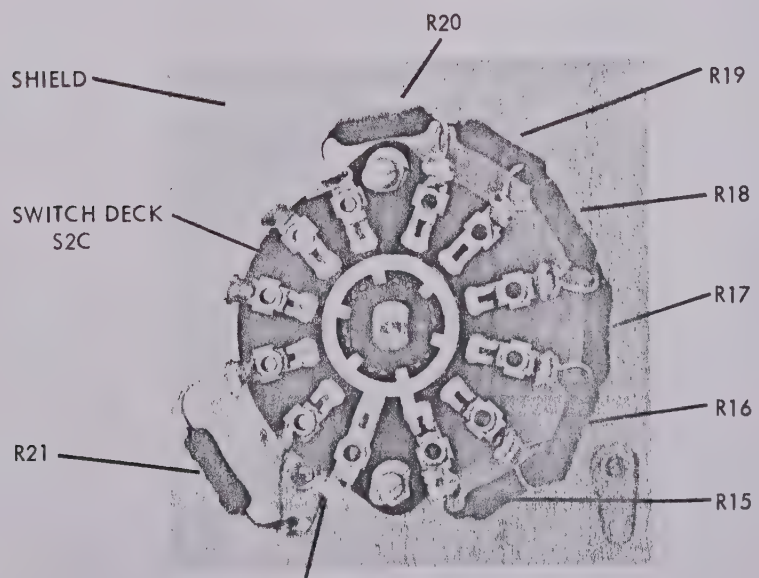


Set the front panel control as follows:

a. Impedance selector switch to 600 ohms.
Function selector to SEL. VM 2500 cycles.
Attenuator switch to -70 db position.
Connect the binding posts for unbalanced input.
Remove the local oscillator tube V10.

b. Feed a very low distortion 100 kc sinewave to the input binding post, at a 0 dbm level.

c. Connect an accurate AC voltmeter such as Hewlett-Packard 400H between the output of the attenuator switch S2C and ground. The voltage at this point should be -16 dbm.



5S

d. At this point switch the line impedance to 135 ohms, the AC voltage should be -10 dbm.

e. Change the binding post arrangement from unbalance to balance. Repeat steps as above using a balanced input signal.

f. Disconnect AC voltmeter and replace local oscillator tube V10.

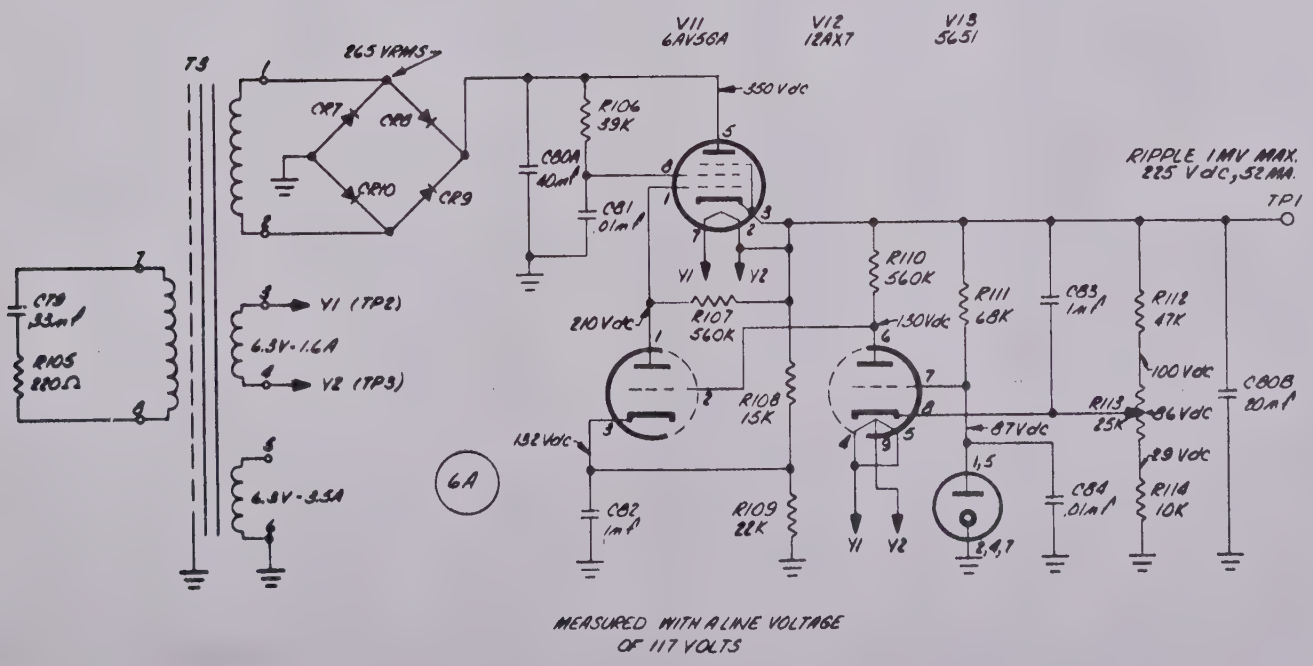
5.5 Flat Voltmeter Adjustment

Test set up as described in paragraph 5.4. Allow a minimum of 15 minutes warm-up period. Set the front panel controls as follows:

Impedance selector switch to 600 ohms. Function selector to Flat Voltmeter. Attenuator switch to a 0 db position. Connect the binding post for unbalanced or balanced to suit signal source used.

5.5.1 Level Adjustment:

Feed a very low distortion 100 kc sinewave to the input binding post at a 0 db level. Set the amplifier gain by adjusting the feedback voltage. Trim the feedback by means of potentiometer R71 for a meter reading of exactly 0 db.



MEASURED WITH A LINE VOLTAGE OF 117 VOLTS

5.5.2 Frequency Response:

Change the input signal successively to 1, 3, 10, 50, 200, 300, 400, 500, 620 kc at 0 dbm level. Record the meter reading for each frequency. All the readings should be within ± 0.2 db or better.

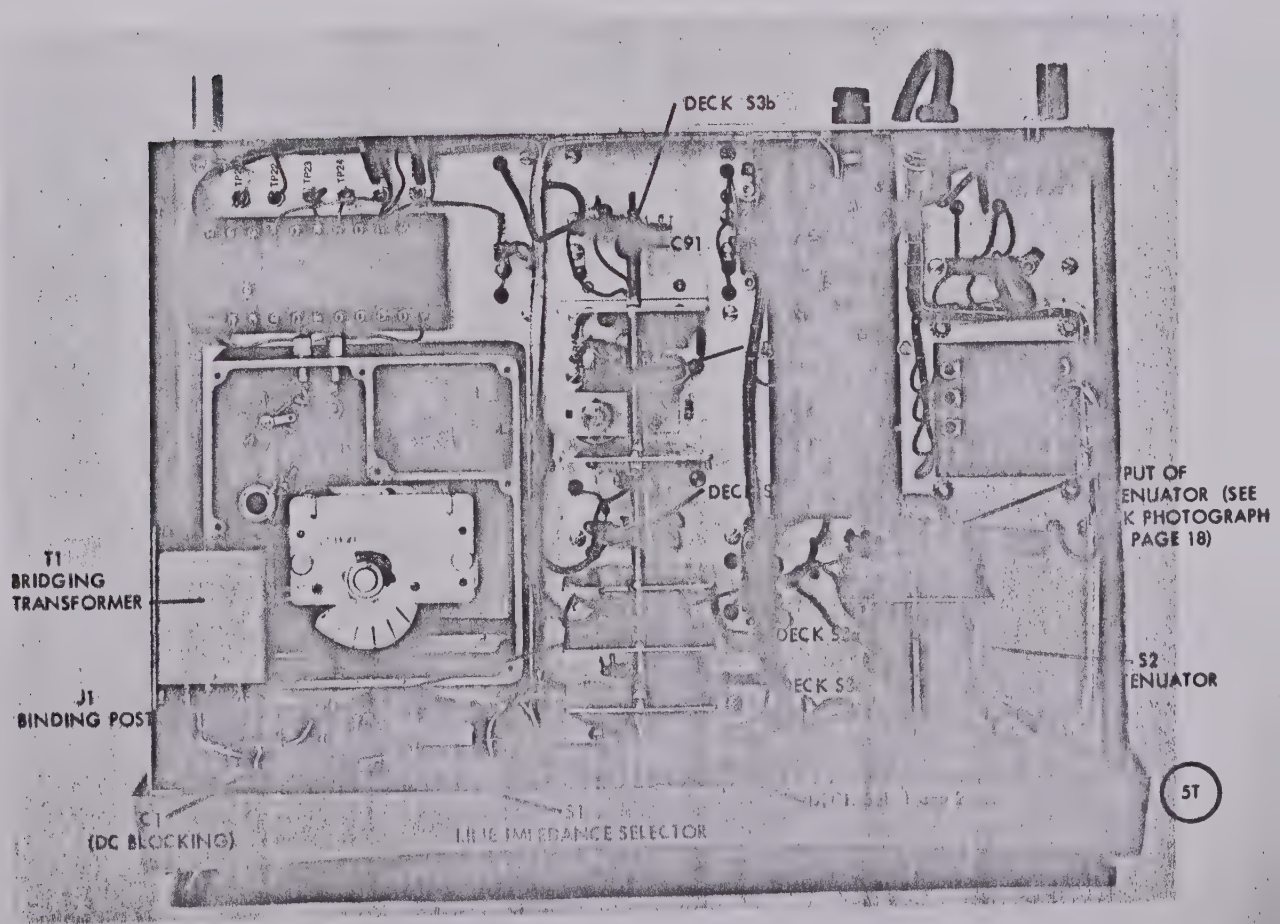
5.5.3 Meter Scale Linearity:

Feed a 100 kc sinewave at the input binding posts at a 0 db level. The Model 125A should read exactly 0 dbm, using an accurate attenuator. Attenuate the input signal by 1 db steps until the signal is attenuated 10 db. Record the meter reading for each step. All readings should be within 0.2 db of the actual level. Attenuate 5 more db The meter should read -15 db within 0.2 db. Attenuate an extra 5 db The meter should read 20 db within 0.2 db. If not within the limits refer to the Maintenance Section, paragraph 6.7.3

5.6 Mixer and IF Amplifiers Tuning

Test set up as described in paragraph 5.4. Set the front panel controls as follows:

Function Selector to SEL. VM 2500 cycles.
IF gain control fully CW.
Set a jumper from binding post J1 to the output of the attenuator switch S2C.



Feed a 2.215 MC signal at the input of the Model 125A at the required level to give a 1/2 scale reading on the meter. Tune successively L3, L4 and L5 for a maximum meter deflection. Keep decreasing the input signal level to maintain the meter reading within range. After tuning it should take approximately 1.0mV signal for full scale deflection. In case of difficulties refer to Maintenance Section, paragraph 6.5.

5.7 Local Oscillator Alignment

Test set as described in Paragraph 5.4. The only adjustment required is the dial scale tracking. Allow a minimum 15 minutes warm-up period. Set the front controls as follows:

(a) Function selector to SEL. VM. 2500 cycles
Attenuator to 0 db.
Frequency dial at 3 kc.

(b) Feed a 3 kc sine wave at the input binding post at an approximate 0 dbm level. Tune L11, located immediately behind the dial drum at the right of the oscillator casting, for a maximum meter deflection.

(c) Set the frequency dial to 620 kc and feed a 620 kc signal at the input binding post of the voltmeter. Tune C63, located immediately behind the dial drum at the left of the oscillator casting for a maximum meter deflection.

(d) Repeat several times until 3 kc and 620 kc are right on the mark.

(e) Feed to the input and tune the frequency dial to the following frequencies: 50, 100, 200, 300, 400, 500 kc. They all should be within 1 kc of the dial markings. To bring them right on the mark, bend in or out the external serrated plates of the variable capacitor C62.

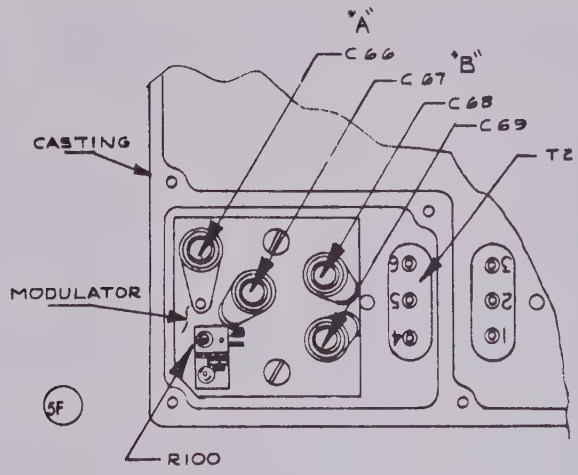
(f) If the frequencies between 150 and 450 kc are several kc off, increase or decrease by a few thousands of an inch the initial full mesh gap, depending on the frequencies being low or high. After tracking, all input frequencies shall fall right on the equivalent dial marking.

5.8 Modulator Adjustment

Test equipment required: Oscilloscope.

(a) Allow a minimum 15 minutes warm-up period. Set the function selector to SEL. VM. 2500 cycles. No input signal. Remove the oscillator casting bottom plate.

(b) Connect an oscilloscope successively at the point "A" and "B" indicated in the photograph below and adjust R100 until their amplitude are equal. The oscilloscope should have a sensitivity of .5 volt/cm and a sweep of .2 usec/cm.



MODULATOR LOCATION WITHIN CASTING

(c) Replace the oscillator casting bottom plate. Tune successively C66, 67, 68 and 69 for a minimum meter reading. Keep bringing the meter reading up by lowering the frequency. When the tuning of these capacitors are optimized, the meter reading shall be no greater than -15 db at the 5 kc dial position.

NOTE: Use a non-metallic screwdriver to adjust the capacitors C68 and C69. In this procedure the meter reading is not influenced by the attenuator position, the detected voltage is due to local oscillator feedthrough. Do not balance the modulator without the unit bottom cover in place, or it will result in improper operation.

5.9 Injection Oscillator Adjustment

5.9.1 Frequency Check:

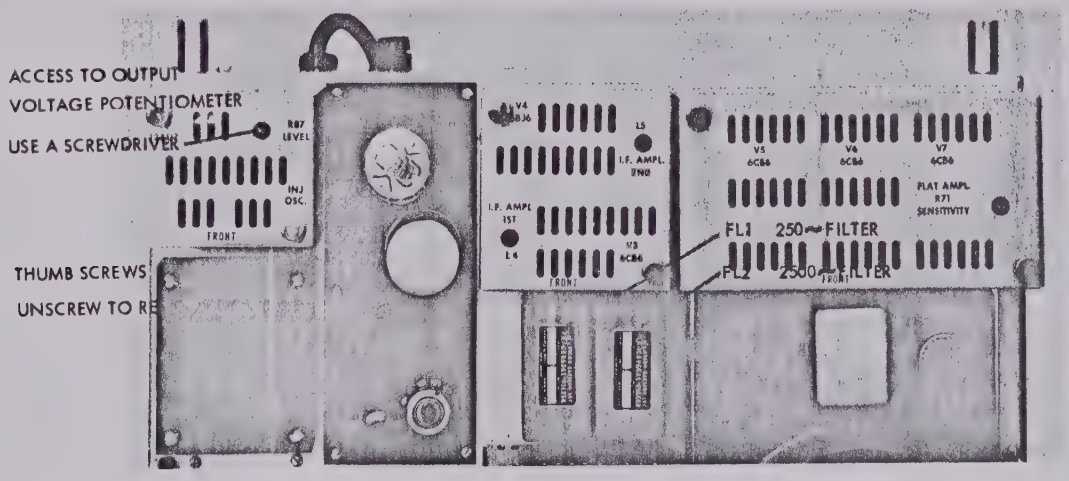
Test setup as described in paragraph 5.11.1. There is no frequency adjustment provision or required. The frequency can be checked by comparing it against an external accurate 100 kc signal fed at the input of the voltmeter.

The best approach is to set the function selector switch to CAL. 2 and tune in the sixth harmonic of the crystal (600 kc). Leave the dial set. Switch the function selector to SEL. VM. 250 cycles and feed a signal at the input of the voltmeter of approximately 600 kc. Vary slowly the input frequency until it tunes in at the dial preset position. Knowing accurately this input frequency, use a frequency counter,

dividing it by 6 gives the crystal frequency. It should be 100 kc ± .02%.

5.9.2 RF Output Level:

No test setup required. The injection oscillator output is set by adjusting potentiometer R87 located in the cathode circuit of V9A.



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Set the function selector to CAL. 1. Switch the attenuator to the 0 db position. Adjust output level potentiometer R87 for a meter reading of exactly 0 db.

5.10 Mixer and IF amplifier Tuning

Test set as described in paragraph 5.4 This is similar to paragraph 5.6.

(a) Set the function selector to SEL. VM. 250 cycles.

(b) Set the attenuator to 0 db.

(c) Set the IF gain control at mid-position.

(d) Feed a 100 kc signal at 0 db level to the input of the voltmeter.

(e) Tune the frequency dial to the incoming frequency and for a maximum meter deflection.

(f) At this point tune L3, L4 and L5 successively for a maximum meter deflection.

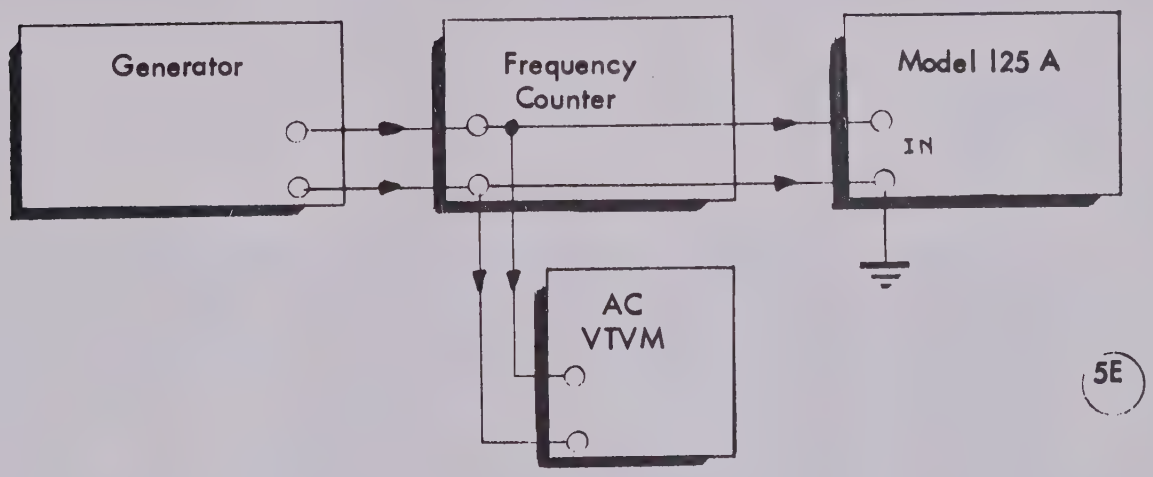
At this stage of the calibration, with a 0 db input signal and the IF gain control set fully clockwise, the Model 125A meter reading shall be between +4 and +6 db. Turning the IF gain control fully CCW shall bring the reading down to at least -5 db.

5.11 Bandwidth Characteristic

The bandwidth skirt of the SEL. VM. 2500 cycles filter shall be at least 1 kc flat and drop down smoothly on either side. The bandwidth at the 3 db points should be 2500 cycles. At the 60 db points: 14 kc. For physical location see page 23.

5.11.1 2500 Cycle Bandwidth Check:

Test setup:



Signal generator, such as Hewlett-Packard 650A high frequency 190 accuracy, a-c voltmeter frequency counter, able to read test frequency within 1 cycle, short, shielded interconnections.

Check as follows:

(a) Set the attenuator to the 0 db position; the function selector to SEL. VM. 2500 cycles. Feed a 10 kc signal at 0 dbm level to the input of the voltmeter. Set the frequency dial for the incoming frequency. Adjust the IF gain control for a 0 db meter reading.

(b) Change the incoming frequency slowly on either side of 10 kc until the meter reading drops .2 db on either side of the maximum. Record the frequency corresponding to these points. The frequency difference represents the flat portion of the bandwidth and shall be at least 1 kc.

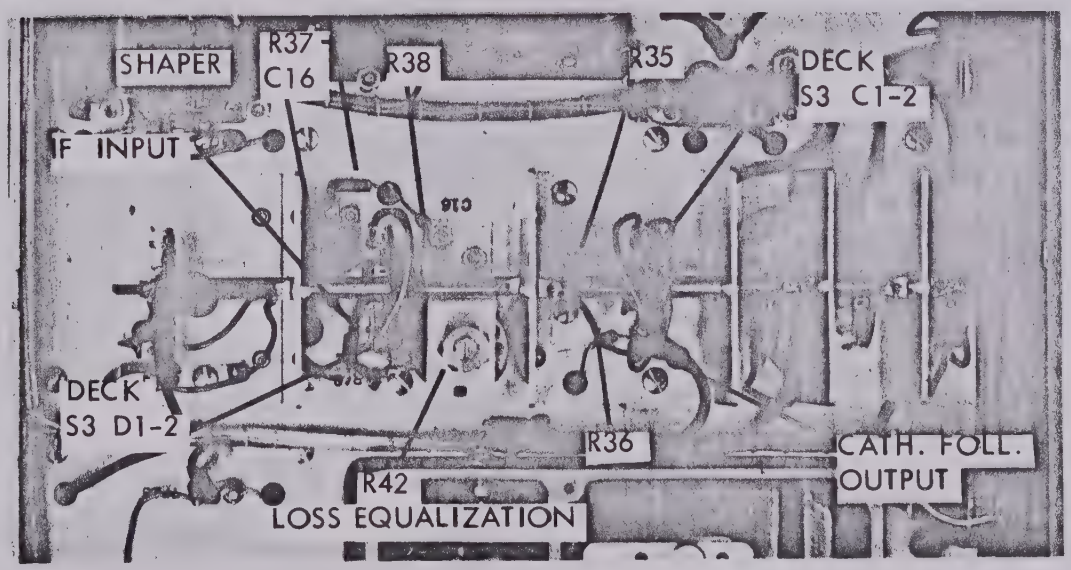
(c) Resetting the incoming signal at 10 kc, and 0 dbm, detune the voltmeter frequency dial toward a lower frequency and increase the sensitivity by switching the attenuator to -60 db. Record the voltmeter

dial frequency corresponding at -60 db meter reading. Repeat by retuning the voltmeter dial toward a higher frequency. The dial frequency spread represents the bandwidth 60 db down and shall be at least 14,000 cycles.

5.11.2 250 Cycles Bandwidth Check:

Check as the 2500 cycles, but switch the function selector to SEL. VM. 250 cycles. The flat top portion of the bandwidth shall be approximately 100 cycles. The bandwidth at the 3 db points should be 250 cycles.

The flat portion width can be adjusted by increasing or decreasing the capacitance of C16. This adjustment is accessible through a hole provided in the cover of the function switch.



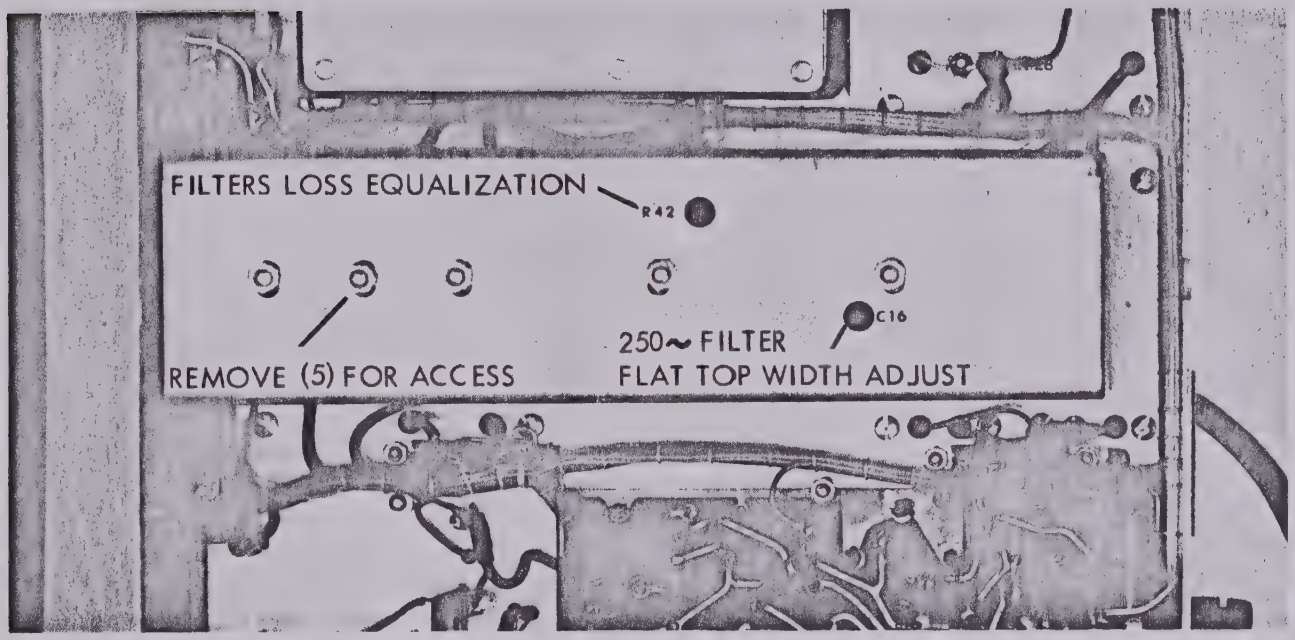
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5.12 Bandwidth Levels

The output of the crystal filters are not necessarily identical and may need equalizing. Proceed as follows:

(a) Set the function selector to SEL. VM. 2500 cycles. Feed a 100 kc, 0 dbm signal at the input binding post of the voltmeter. Set the frequency dial to the incoming frequency and tune carefully for a maximum meter deflection. Record the meter reading.

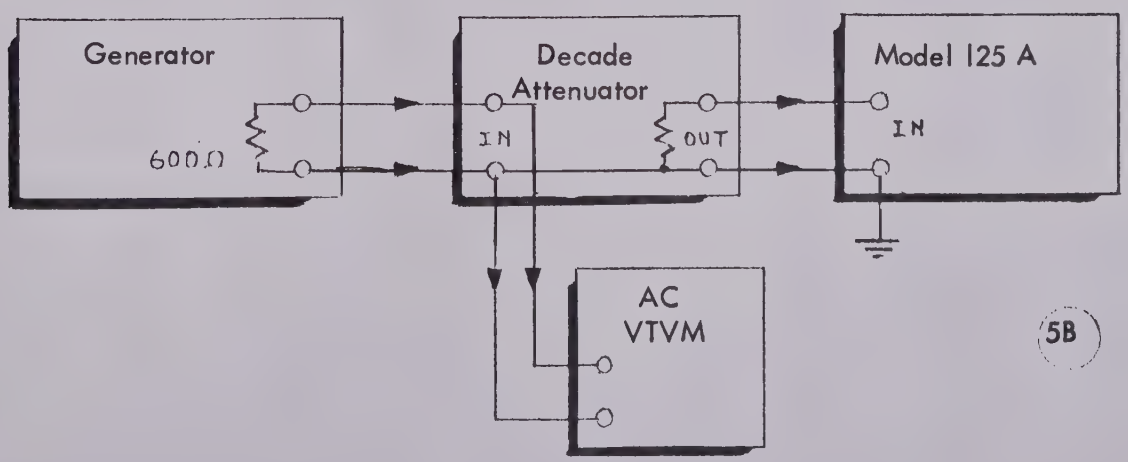
(b) Switch the function selector to SEL. VM. 250 cycles and retune carefully the frequency dial for a maximum meter reading. Now, if the meter reading is different from the reading recorded for the 2500 cycles bandwidth, adjust the potentiometer R42 to match. This adjustment is accessible through a hole in the function selector switch cover.



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5.13 Attenuator Step Check

5.13.1 Test Setup



5B

Signal generator covering 20 kc to 620 kc with an output capability of +20 dbm minimum in a 600 ohm load.

Precision attenuator decade, such as General Radio 1450-B, or Daven Model VT 795-G.

High frequency, 1% accuracy, a-c voltmeter such as Hewlett-Packard 400L (linear decibel scale). Short, shielded interconnections.

5.13.2 Test:

(a) Set the front panel controls as follows:

Attenuator switch to +20 dbm.
Function selector to SEL. VM. 250 cycles.
Impedance selector to 600 ohms.
Binding post connected in unbalanced configuration.
Feed to the input binding post a 20 kc sinewave at +20 dbm.

(b) Switch voltmeter attenuator to +30 db, the meter shall read -10 db.

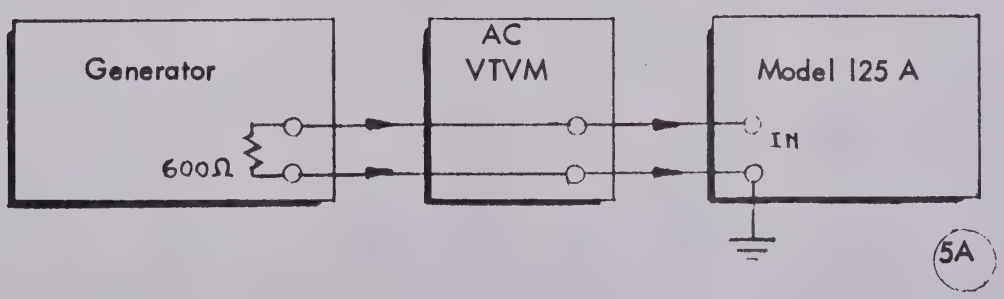
(c) Attenuate the input signal 10 dbm and switch the voltmeter attenuator to +10 db position. The meter should read 0 db, within ± 0.2 db.

(d) Keep attenuating the signal by 10 db steps and increasing the voltmeter sensitivity by 10 db steps, all the way to -70 db. The meter accuracy should remain within ±0.2 db.

(e) Repeat steps (a) to (e) using a 620 kc input signal.

5.14 Selective Voltmeter Frequency Response

5.14.1 Test Setup:



Signal generator, such as Hewlett-Packard 650A. High frequency, 1% accuracy, AC voltmeter such as Hewlett-Packard 400L (linear decibel scale). Short, shielded interconnections.

5.14.2 Response Check:

(a) Feed a 100 kc sinewave to the input binding post of the voltmeter at a 0 dbm level. Set the voltmeter front panel controls as follows:

Function selector to SEL. VM. 250 cycles.
Attenuator at the 0 db position.
Frequency dial to the incoming frequency.
Set IF gain control for a 0 db meter reading.

(b) Successively feed and tune the frequency dial to the following frequencies at a 0 dbm level; 3, 10, 50, 200, 300, 400, 500 and 620 kc. Record the meter readings for all these frequencies. All readings shall be within 0.5 db.

(c) Repeat steps (a) and (b) with the input frequencies at a level of -70 db and the voltmeter attenuator switched to -70 db. All readings shall be within 0.5 db.

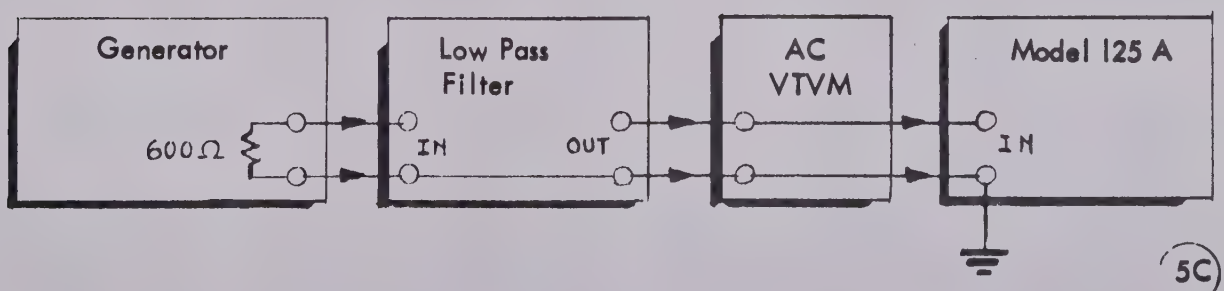
5.15 Harmonic Generation and Intermodulation

5.15.1 Harmonic Generation:

To check the harmonic generation it is necessary to have a generator and associated low pass filter providing frequencies with all harmonics down at least 90 dbm.

5.15.1.1 Test Setup

Signal generator, such as Hewlett Packard 650A, adequate low pass filter. High frequency, 1% accuracy, a-c voltmeter. Short, shielded interconnections.



5C

The test frequency is not important, but a 100 kc is a convenient figure.

(a) Feed a 100 kc sine wave to the input binding post of the Model 125A at a 0 dbm leve.

(b) Set: The function selector switch to SEL.VM. 2500 cycles.
The attenuator to the 0 db position.
The frequency dial to the incoming frequency.
The IF gain control for a 0 db meter reading.

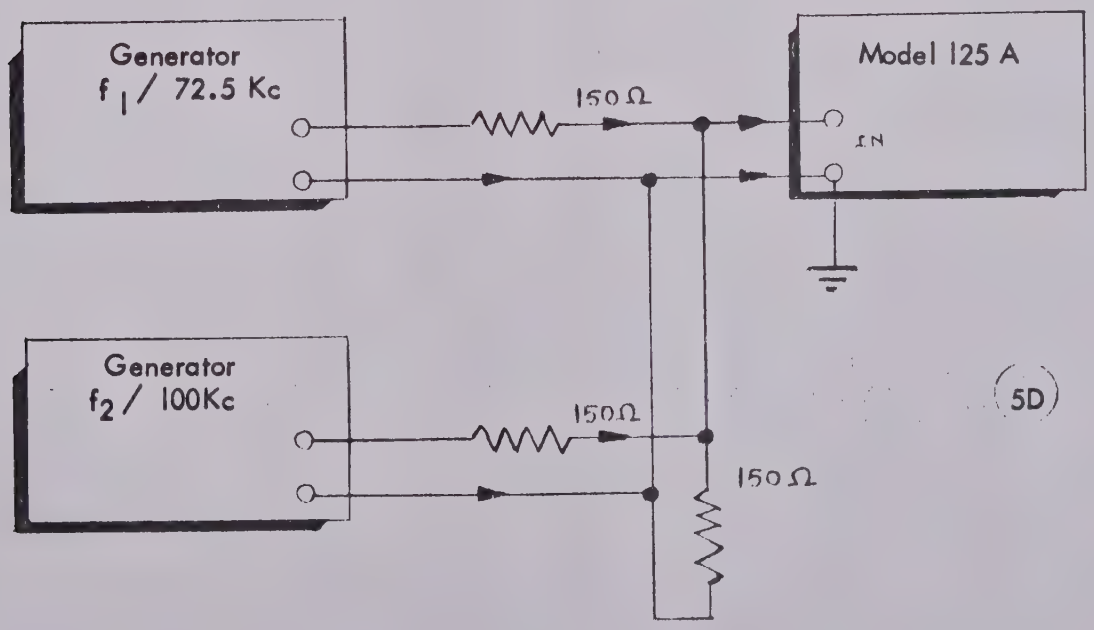
(c) At this point mcve the frequency dial of the voltmeter to approximately 200 kc, switch the attenuator to -60 position. Tune in the second harmonic of the incoming signal -200 kc, its level shall be at least 60 db down.

(d) Check successively the third, fourth, fifth and sixth harmonic. They shall be at least 60 db down.

NOTE: Typical harmonic generation figure are given in the Maintenance Section, paragraph 6.5.4.

5.15.2 Intermodulation Measurement

The intermodulation is measured by feeding simultaneously two frequencies at an identical level to the frequency selective voltmeter input.



(a) Set: The first generator to a frequency f_1 of 72.5 kc.

The second generator to a frequency f_2 of 100 kc.

The output level of each, independently, at 0 dbm. Connect them to the Model 125A through a mixing pad as shown above.

(b) Set the voltmeter front panel controls as follows:

Function selector to SEL. VM. 2500 cycles.
Attenuator switch to 0 db position.
Frequency dial to either f_1 or f_2 frequency and adjust IF gain control for a 0 db meter reading.

(c) Leave the generators and voltmeter IF gain control as set throughout the following steps.

(d) Change the frequency dial setting successively to the following frequencies with the voltmeter attenuator switch in the -60 db position.

$f_1 + f_2$	172.5 kc
$f_2 - f_1$	27.5 kc
$2f_1 - f_2$	45 kc
$2f_1 + f_2$	245 kc
$2f_1 - f_1$	127.5 kc
$2f_2 + f_1$	272.5 kc

At all these frequencies, the intermodulation product shall be at least 60 db down.

NOTE: Typical intermodulation product figures are given in the Maintenance Section, paragraph 6.5.5.

5.16 Noise Level

The normal noise level of the instrument with no input, in the SEL.VM. 2500 cycles position, is a -20 db or less, meter reading with the IF gain control fully CW. The attenuator can be in any position. The largest portion of the noise is generated in the mixer stage and cannot be eliminated without deteriorating the mixer performance. The noise level is function of the mixer low input voltage, high gain, plate and screen currents.

6.0 MAINTENANCE SECTION

6.1 General Information

6.2 Tube Replacement Chart

6.3 Local Oscillator And Modulator

6.4 Power Supply

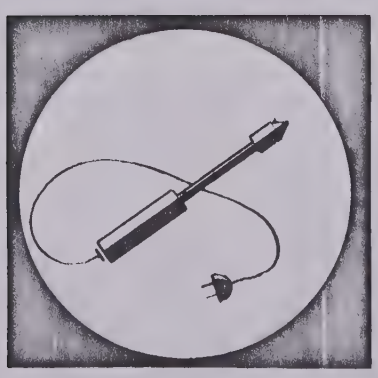
6.5 Mixer

6.6 IF Amplifiers

6.7 Flat Voltmeter

6.8 Injection Oscillator

6.9 Input Circuitry



6.1 General Information

A. Trouble Shooting:

To assist in trouble shooting, charts of circuit typical resistances and circuit with typical d-c and a-c voltages have been prepared. Trouble can usually be found quickly by sectionalizing, and second by localization within the section by means of voltage and resistance measurements. The circuit sections are indicated in the block diagram, Figure 2.

The first step in sectionalizing is to check the output of the regulated d-c voltage supply: the d-c voltage at test point TP1 should be 225 volts ± 2 volts. If the regulator output is not within the limit refer to paragraph 6.4.

The second step in sectionalizing is to check the ripple and noise content of the regulated d-c voltage supply: the ripple content should not exceed 1 millivolt RMS. Excessive ripple and noise is not necessarily due to the regulator circuit and can be caused by defective decoupling network, leaky or open capacitors.

After this basic cause of trouble has been checked and eliminated, determine if, either or neither, the flat voltmeter or selective voltmeter operate.

The Flat voltmeter circuit failure can be caused only by power or input circuit failure, or within its own circuitry. On the other hand, the selective voltmeter operation will be disrupted by the failure of any sections (except the injection oscillator).

Occasionally a coupling or decoupling capacitor will be found that is slightly leaky only when the instrument is operated in its case and at relatively high ambient. When the instrument is operated with its case off, components run below normal operating temperatures.

Microphonics can be caused by poor electrical contact in impedance selector or function switch, by loose solder joints or electron tubes.

B. Preventive Maintenance:

To obtain optimum performance from the equipment, a program of regular preventive maintenance should include the following:

1. Mechanical inspection of the unit for loose, broken or damaged components.
2. An inspection and adequate cleaning of all switch contacts.
3. Measurement of the regulated d-c voltage and ripple content.

4. An inspection of the power cord condition.

5. Verify current rating of fuse.

6. An inspection for loose screws, nuts, broken wires, loose subassembly.

C. NOTE:

These instructions do not purport to cover all details or variations in instrument nor to provide for every possible contingency to be met in connection with maintenance. Should further information be desired, or should particular problems arise which are not covered sufficiently for the purchaser's purpose, the matter should be referred to the nearest Sierra Electronic Corporation representative or direct to Sierra Electronic Corporation, Sales Department.

6.1.1 Removing The Cabinet

The Model 125A chassis and panel are removed from the cabinet by removing the two retainer screws on the rear of the cabinet and sliding the chassis forward out of the cabinet.

CAUTION: Take adequate safety precautions when the cabinet is removed. Dangerous voltages are exposed.

6.1.2 Servicing Etched Circuit Boards

Printed circuits have definite advantages in servicing and trouble shooting. They are free of errors sometimes encountered in conventional wiring, leads are easily seen and components are easily accessible. Readings can be taken directly at the socket pins and at most component leads on either the top or bottom of the printed boards. Replacing components on printed boards is relatively simple. Damage can be done to the printed board however, by excessive heat applied during soldering. Overheating can cause the bond between the board and the copper foil to break.

While applying the soldering iron to each individual solder point, brush off any molten solder with a small brush. Take care not to spread solder in order to avoid shorts. In the event that the copper foil has been damaged, the break can be repaired by flowing solder across the break, or if the gap is too large, it can be bridged by soldering a piece of hook-up wire across the gap. If the copper foil becomes raised from the board, clip off the raised portion and replace it with a section of wire. When replacing solid state diodes or precision resistors use some kind of heat sink on the leads to avoid overheating these components and alter their characteristics. Before replacing a in-circuit damaged components determine and eliminate the reason to avoid repeating the same failure.

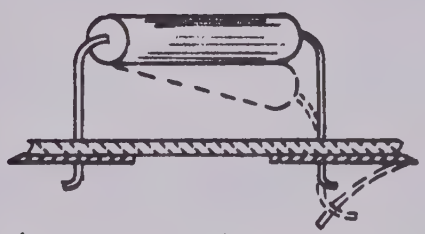
When servicing printed boards DO NOT push or pull wires in such a way as to raise the printed wiring from the board.

When soldering, use a 50 watt iron or smaller. Apply heat sparingly to the leads on the part to be removed, or installed, not to the printed wiring on the board.

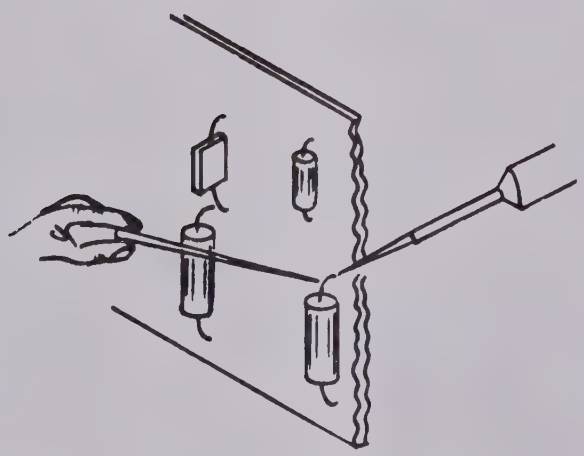
Before installing new parts, clean holes to receive new parts leads without forcing. To insure easy solder with low heat dissipation tin the part leads before mounting on the board. Hold always the part against the board when soldering to avoid "push thru".



"PUSH THRU" PREVENTED

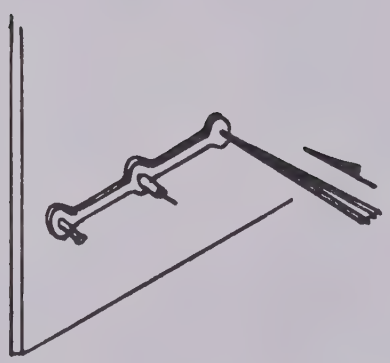


"PUSH THRU" POSSIBLE



APPLY HEAT ON LEAD
REMOVE WHEN SOLDER SOFTENS

6K



CLEAN HOLE WITH AWL

6.2 Tube Replacement Chart

Tubes with standard EIA characteristics can be used for replacement. In a great number of cases, instrument trouble can be traced to a defective or weak tube. Replace only those tubes proven to be defective or weak. Check tubes by substitution. Results obtained through the use of a tube "checker" can be erroneous and misleading.

The solid state diodes used in the circuitry have been carefully selected for definite characteristic, replace only by same type and same manufacturer as described in the list of replaceable parts.

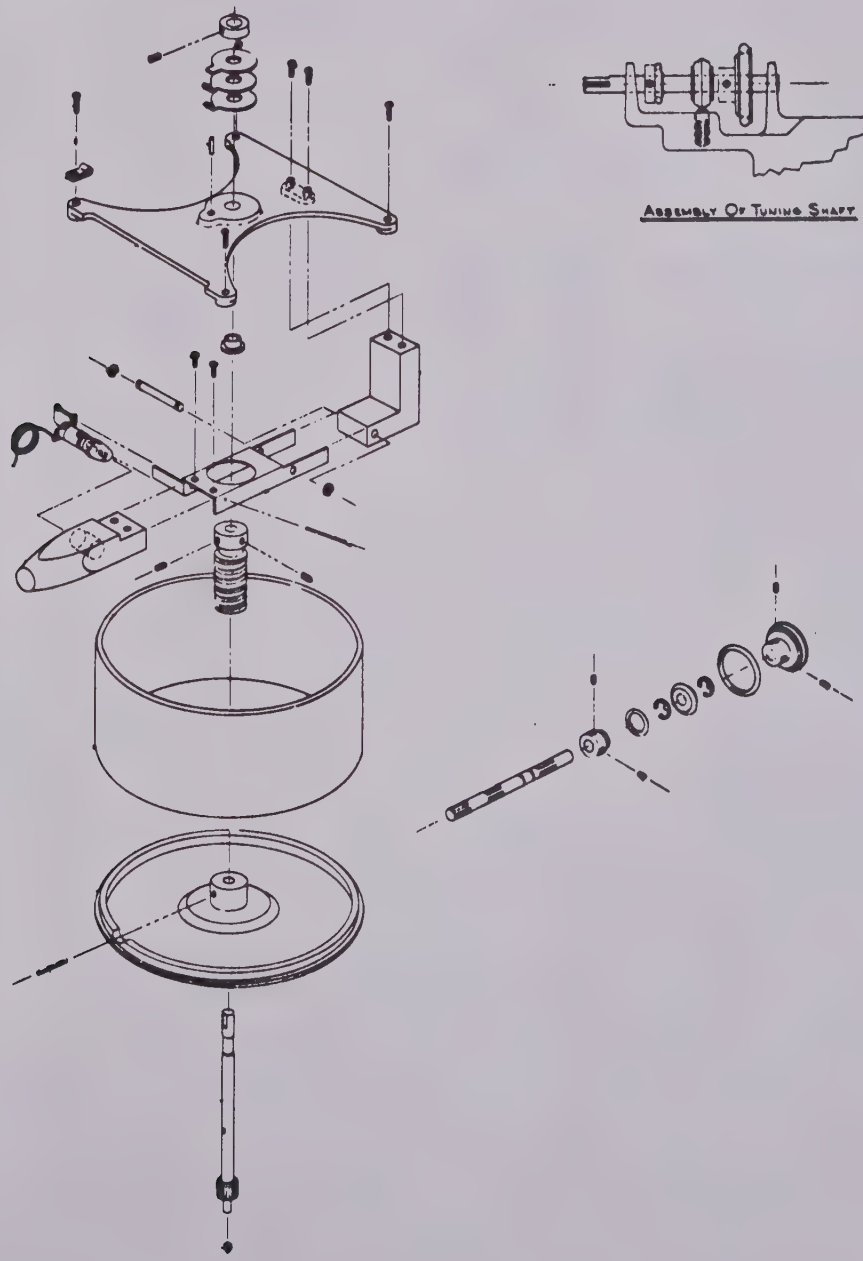
DESIGN	TYPE	FUNCTION	ADJUSTMENT REQUIRED
		MIXER STAGE	
V1	6AH6	Mixer	Readjust L3 (Paragraph 5.10 Rebalance Modulator (Paragraph 5.8) Check Harm. Generation (Paragraph 5.15.1)
V2	6CB6A	Cathode Follower	Readjust L3 (Paragraph 5.10)
		IF AMPLIFIER	
V3	6CB6A	Amplifier	Readjust L4 (Paragraph 5.10)
V4	6BJ6	Amplifier	Readjust L4 - L5 (Paragraph 5.10)
		FLAT VOLTMETER	
V5	6CB6A	Amplifier	Readjust R71 (Paragraph 5.5.1)
V6	6CB6A	Amplifier	Readjust R71 (Paragraph 5.5.1)
V7	6CB6A	Amplifier	Readjust R71 (Paragraph 5.5.1)
V8	12AU7	Audio Amplifier	None Required
		INJECTION OSCILLATOR	
V9	12AU7	Oscillator and Cathode Follower	Readjust RF Output Level R87 (Paragraph 5.9.2)
		LOCAL OSCILLATOR	
V10	12AU7	Oscillator and Cathode Follower	Track Dial Calibration (Paragraph 5.3) Rebalance Modulator (Paragraph 5.8)
		POWER SUPPLY	
V11	6AV5GA	Pass Tube	Readjust Voltage Setting R113 (Para. 5.2)
V12	12AX7	DC Amplifier	Readjust Voltage Setting R113 (Para. 5.2)
V13	5651	Voltage Reference	Readjust Voltage Setting R113 (Para. 5.2)

6.3 Local Oscillator And Modulator Subassembly

6.3.1 Oscillator

6.3.1.1 Mechanical

No mechanical item of the drive mechanism requires lubrication. Every six months lubricate the ball bearings of the variable capacitor C62 with some "Lubriplate" , after removing dust or dirt with a moderate air stream.



Assembly Of Tuning Shaft

1. Unit Removal

The local oscillator unit is one complete subassembly mounted to the front panel only. To remove it from the panel proceed as follows:

(a) Disconnect the following leads at the bottom rear section of the unit:
B+
Filament
Modulation

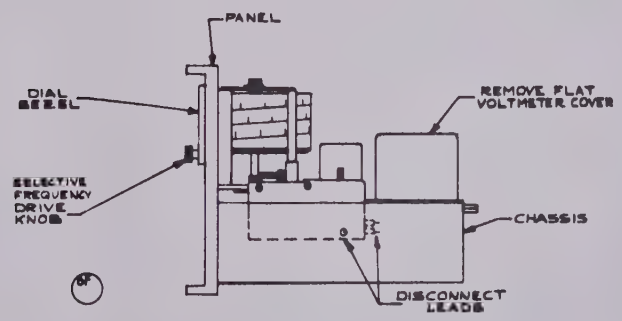
(b) Disconnect the pilot light by removing the lead soldered to the socket within the dial drum.

(c) Remove the flat voltmeter cover.

(d) Remove the tuning dial knob located on the front panel and fastened by a set screw.

(e) Remove the dial bezel by unscrewing the four binder head screws located behind the front panel.

(f) Hold the local oscillator unit firmly and remove the four binder head screws located on the front panel in the area where the dial bezel was located.



2. Dial Drum To Variable Capacitor Coupling

The variable capacitor C62 is coupled to the dial drum gear "A" by a tension loaded gear "B" secured to its shaft by a set screw "C". For proper relationship between these two units, proceed as follows:

(a) Uncouple the variable capacitor drive gear "B" from the oval drum gear "D" by lifting it away from the casting until disengaged.

(b) Turn the dial to the 3 kc marking.

(c) Tension the rear "B" by rotating in opposite direction the two superposed sections. See sketch below.

(d) Push the gear "B" down and engage with dial drum gear "D".

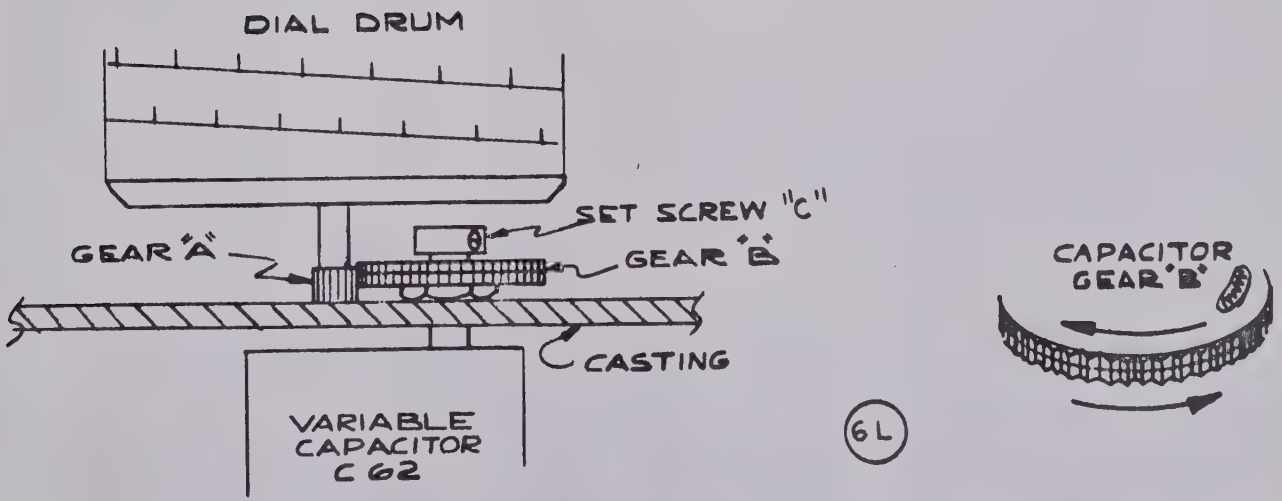
(e) Fully mesh the variable capacitor C62, then back it off approximately .010 of an inch.

(f) Tighten gear "B" set screw "C".

(g) Rotate the dial over the full range to check the mechanism. The rotation should be smooth with no tight-spots. No backlash should be present.

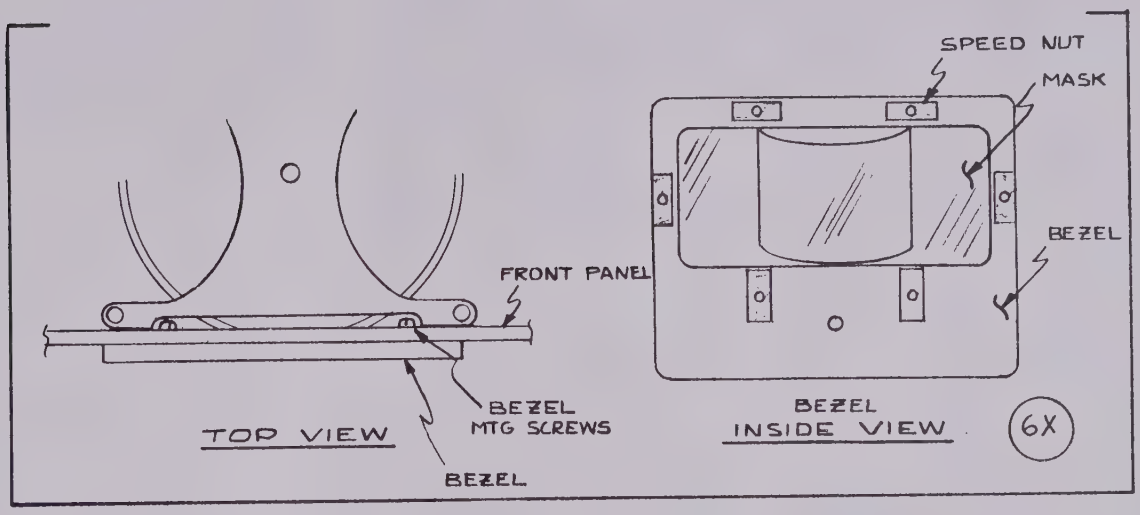
(h) Recalibrate the dial tracking as described in paragraph 5.7 of the calibration section.

NOTE: Adjustment of preset controls.
The only preset controls are the inductor and trimmer capacitor associated with the frequency range. Adjustment follows normal practice, namely, setting inductance at the low-frequency end of the range and capacitance at the high frequency end.



3. Bezel Removal

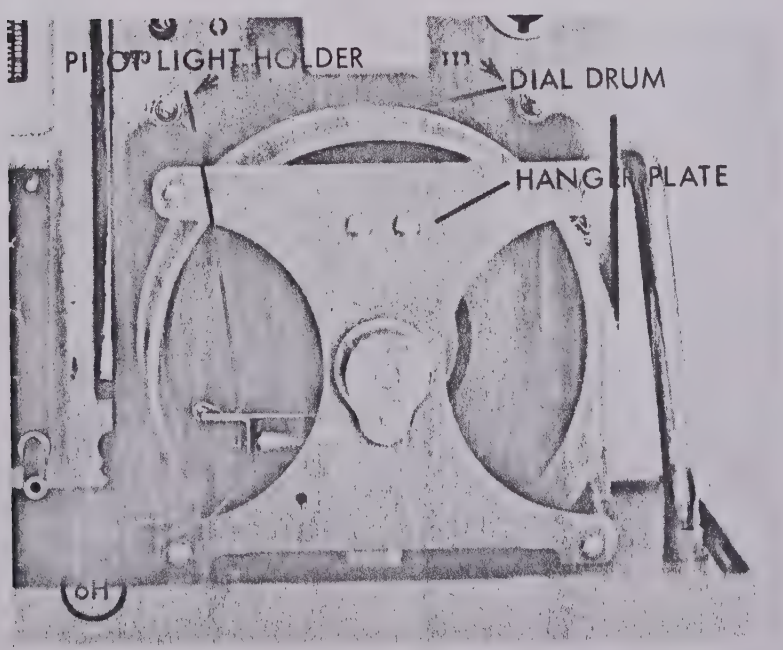
The tuning dial bezel is removed by unscrewing the four binder heads located immediately behind the front panel and removing the tuning knob. The glass window is replaced by snapping off the rings holding the mark in the bezel, removing the bezel then the glass.



6.3.1.2 Electrical

A. Frequency Dial Bulb Replacement:

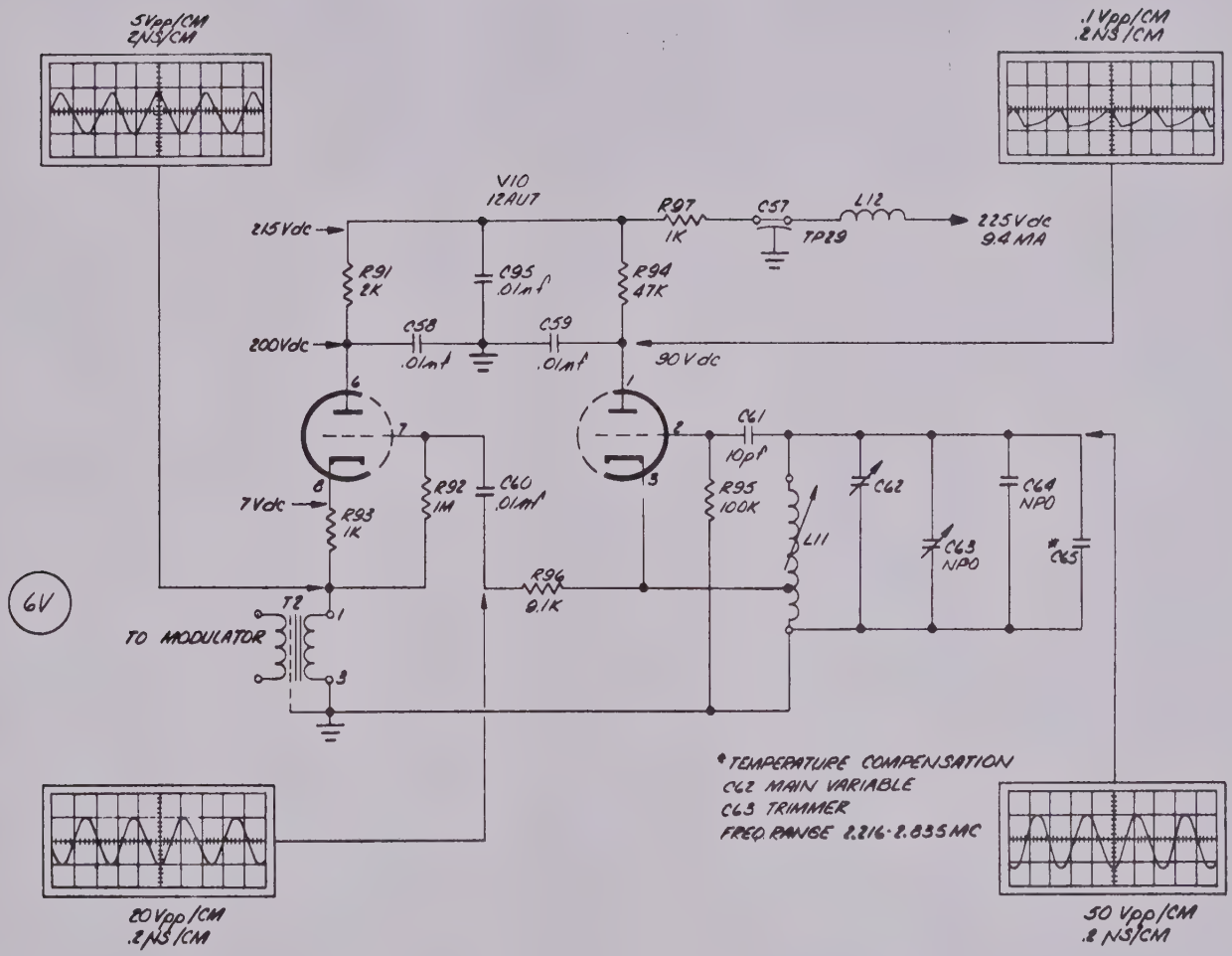
The bulb used to illuminate the tuning dial spot is mounted in a bayonnet socket clipped on a bracket within the dial drum. To replace, slip the socket off the bracket and renew with a bulb Type 47.



B. Access To Circuit:

Remove the casting bottom cover plate by unscrewing the eight (8) binder heads.

C. Circuit And Typical Voltages:



All d-c voltages measured with a high impedance voltmeter such as Hewlett-Packard 410B. All AC-RMS voltages measured with a high impedance voltmeter such as Hewlett-Packard 400C.

The total normal current of the local oscillator supply is 9.4 mA ± 5%.

4. Local Oscillator Resistance Measurement

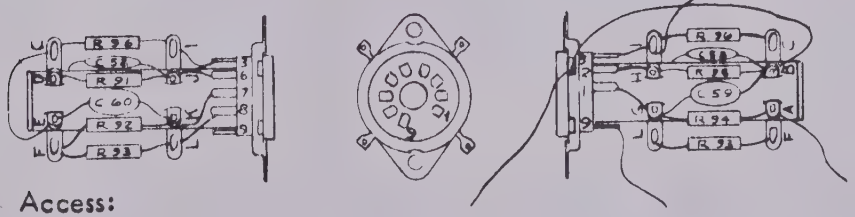
Total Point	Resistance*
V10 Pin 1	80 k Ω
2	100 K Ω
3	.3 Ω
6	30 K Ω
7	1M Ω
8	1 K Ω
Feed Thru C57	30 K Ω
T2 Terminal 1	4.6 Ω
T2 Terminal 2	Short
T2 Terminal 3	Short

*All resistance measurements in respect to chassis ground, with an ohmmeter such as Weston Model 980, or Simpson 260.

5. Part Replacement

After replacing any part in this circuitry, mainly tube V10, inductor L 11 or capacitors C60 through C65, tuning dial tracking will be required. The tracking procedure is fully described in paragraph 5.7, of the Calibration Section. Be sure to replace the bottom cover before calibrating. In any instance, do not alter the local oscillator wiring, mainly the grounding wiring. Serious trouble could develope in the local oscillator or any other circuit of the Model 125A. It is not necessary to remove the local oscillator unit from the panel for part replacement. All components are accessible by removing the bottom cover plate. To replace components mounted on the turret socket XV10, it is recommended to disconnect all leads from it, uncrew the two 4-40 mounting screws and remove the turret from the oscillator casting. Replace by reversing the above steps. In order to maintain the oscillator characteristic, it is mandatory to follow the part list information. For location of components see photograph Page 42

Oscillator Turret: The sketch below will facilitate to locate the components associated with the oscillator tube.



6.3.2 Modulator

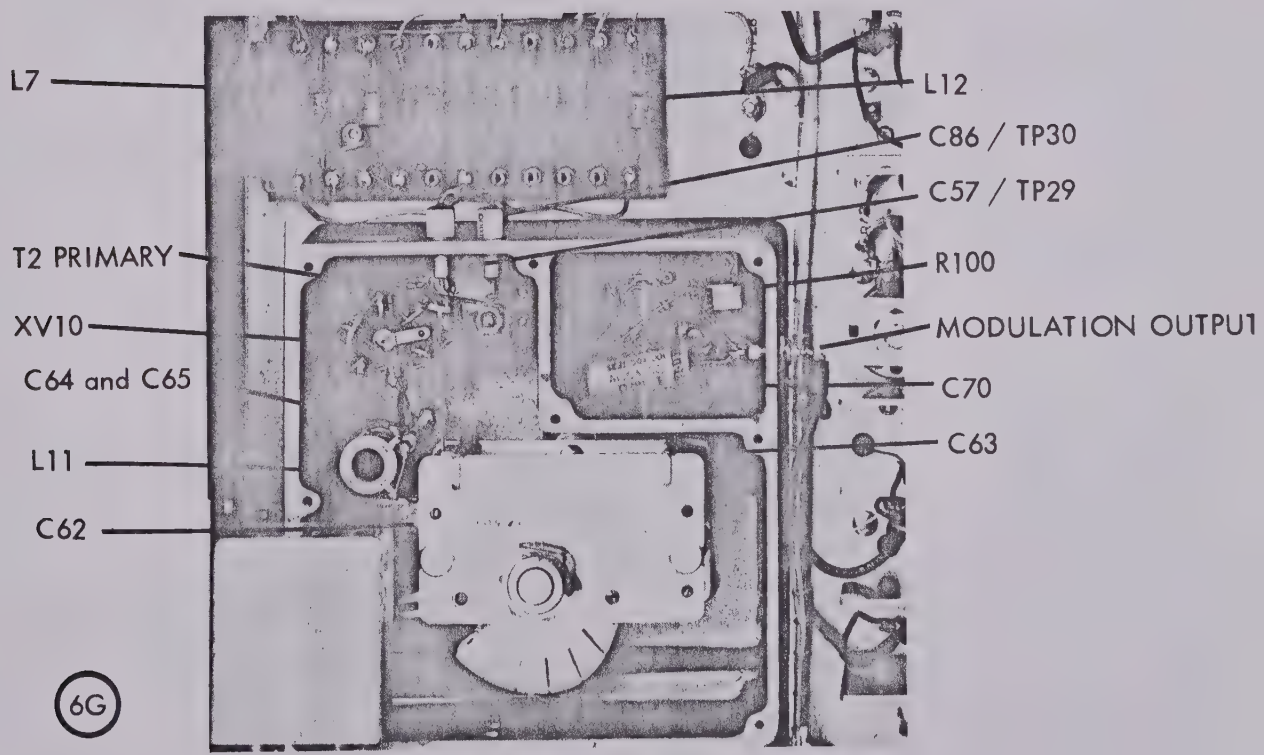
6.3.2.1 Access:

To have access to the modulator circuit, remove the casting bottom cover plate. The modulator is located at the rear in a section shielded from the oscillator section.

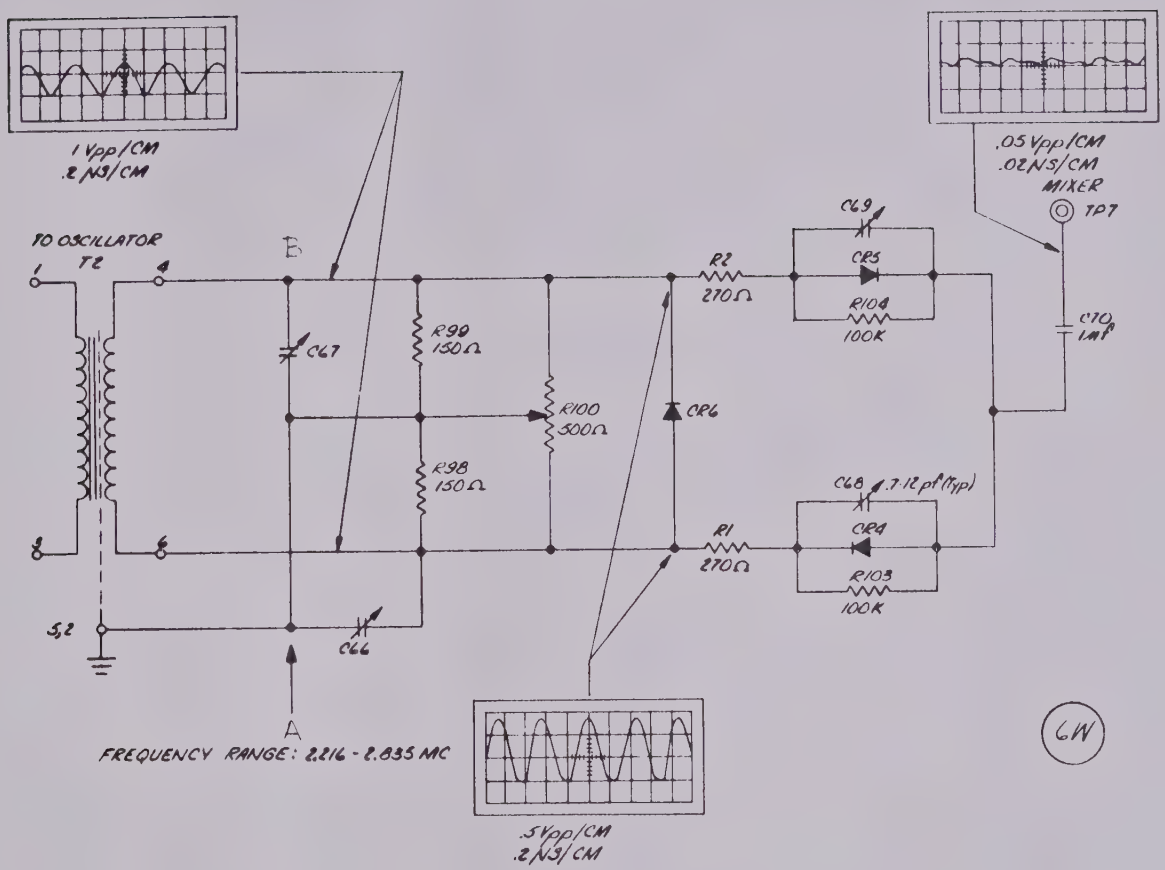
6.3.2.2 Part Replacement:

All the modulator components except for the driving transformer and the output coupling capacitor are mounted on a glass melamine board fastened to the casting by two screws. Loosen the two screws, unsolder the three wires connected to terminals 4 , 5 and 6 of transformer T2. Remove capacitor C70 located between C68 and the casting feed through connector. Pull out the subassembly.

Rewire as previous using the replacement part described in the part list. Do not attempt to use other types of diodes, even if manufacturers suggested equivalent. After replacing any of the components in this circuit, it is necessary to rebalance the modulator. Proceed as in paragraph 5.8 of the Calibration Section. While replacing diodes, avoid over heating and damaging of these units by placing a plier or a clip on the leads.



6.3.2.3 Circuit And Typical Waveforms



6.3.2.4 Typical Resistance

Test Point	Resistance *
TP 31	4700 Ω
A or B	45 Ω
T2 Term 1	4.6 Ω
T2 Term 2-5	Short
T2 Term 4	45 Ω
T2 Term 6	45 Ω
Point B or C	300 Ω
Point D	2000 Ω

* To Chassis Ground

6.4 Power Supply

CAUTION: Exercise care in checking the power supply. Because of the high current capabilities and low impedance the power supply can produce harmful shocks.

6.4.1 General

All the filament voltages and voltage for the d-c rectifiers are furnished by a single transformer T3 located on the top left side of the chassis.

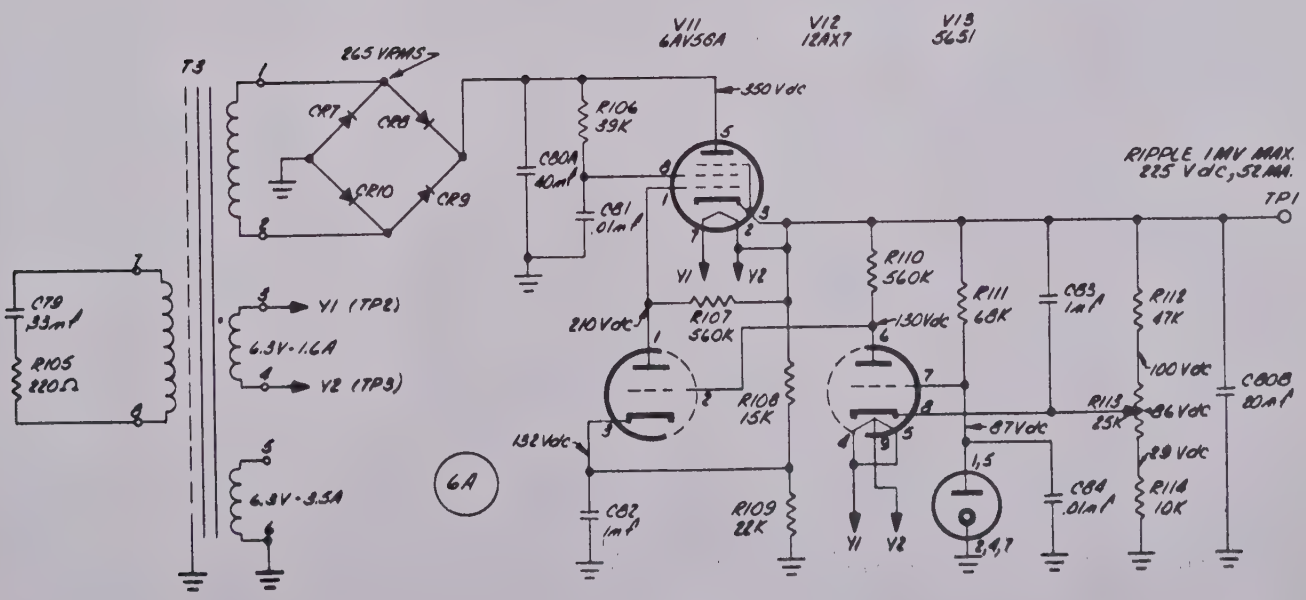
The complete rectifiers and regulator circuit are mounted on the printed board. The board is fastened directly to the chassis by six (6) binder head screws.

All d-c voltage measurements should be made with an instrument having a 20,000 ohms per volt or more sensitivity and accurate.

Measurement of the ripple on the supply provides a convenient check upon the operation of the regulating circuit. Whenever the ripple is below 1 mV, the regulation will be within specification.

6.4.2 Circuit and Typical Voltages

NOTE: The regulator filament circuit is tied to the B+. Filament voltage measurement have to be made between TP2 and TP3, never to ground.



MEASURED WITH A LINE VOLTAGE OF 117 VOLTS

6.4.3 Typical Power Supply Resistance

Test Point	Resistance*
T3 - 1 and 2	co
T3 - 7 and 8	co
T3 - 3 and 4	30K
T3 - 5	oo
T3 - 6	Short
V11 pin 1	560K
V11 - 3/TP1	30K
V11 pin 8	———
V11 pin 5	———
V12 - 1	560K
V12 - 2	560K
V12 - 3	18K
V12 - 6	560K
V12 - 7	95K
V12 pin 8	22K
V13 pin 1-5	95K
V13 pin 2-4-7	Short

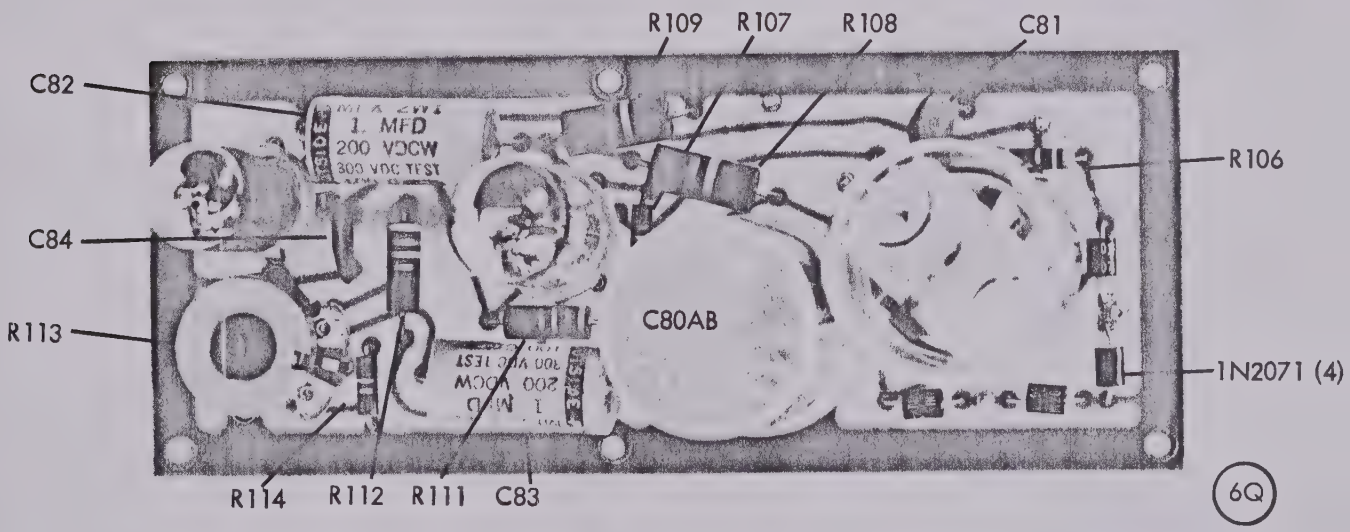
*To Chassis Ground

6.4.4 Voltage Setting

The B+ voltage is set to 225 volts by the potentiometer R113. This voltage is measured from TP1 to chassis ground. An accurate voltmeter should be used. The supply must remain within the specified tolerance for the instrument to retain its calibration.

6.4.5 Part Replacement

After replacing any tube in the circuit, it is necessary to reset the voltage output as described above. To maintain the supply characteristics the parts list should be followed closely.



6.5 Mixer

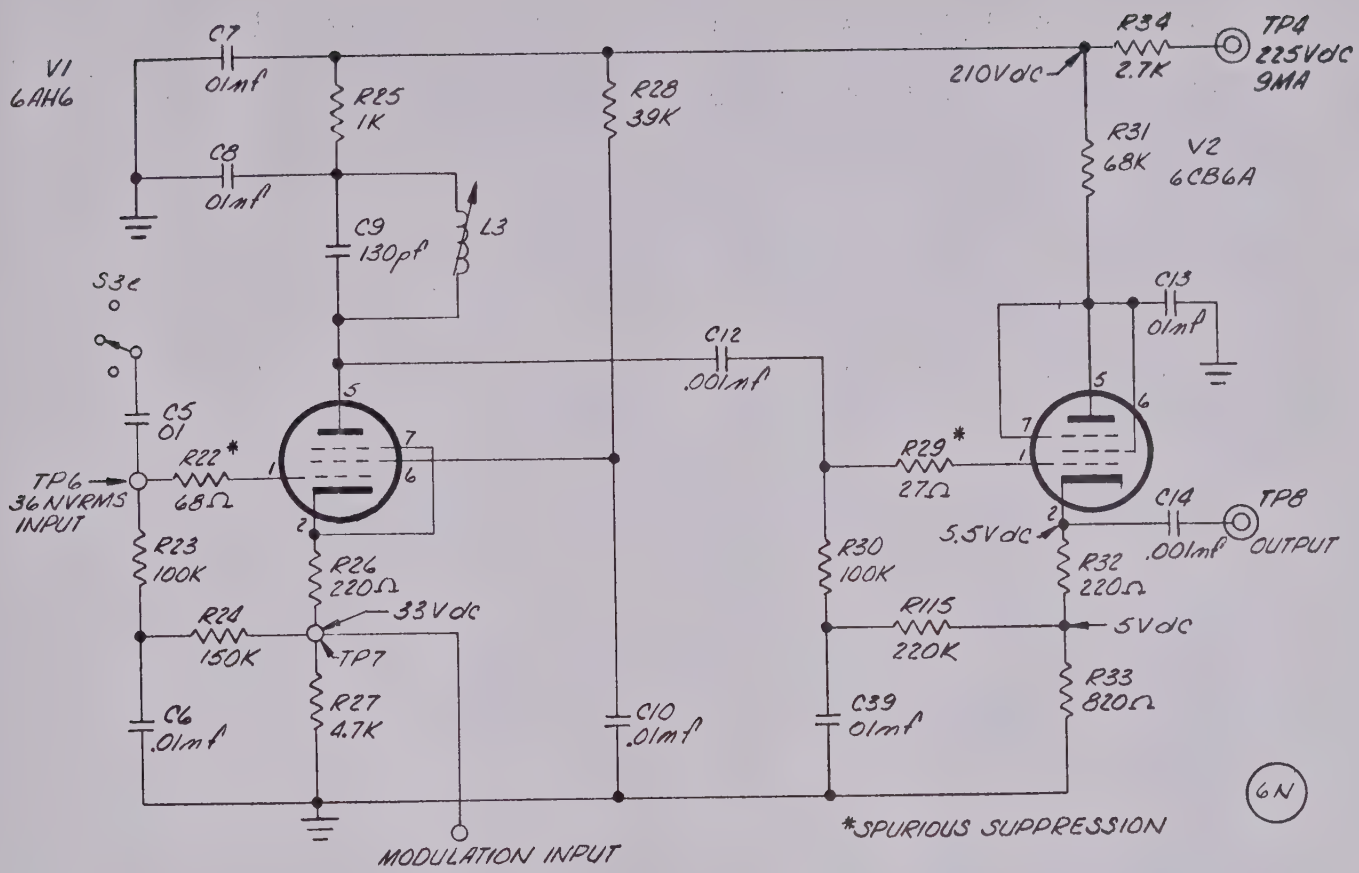
6.5.1 Unit Removal

The complete mixer and associated cathode follower is assembled on a printed circuit board mounted at the center front of the chassis. It is mounted off the chassis on four stand offs and fastened to them by two nuts and two threaded spacers. If necessary, to remove the board from the chassis for servicing, proceed as follows:

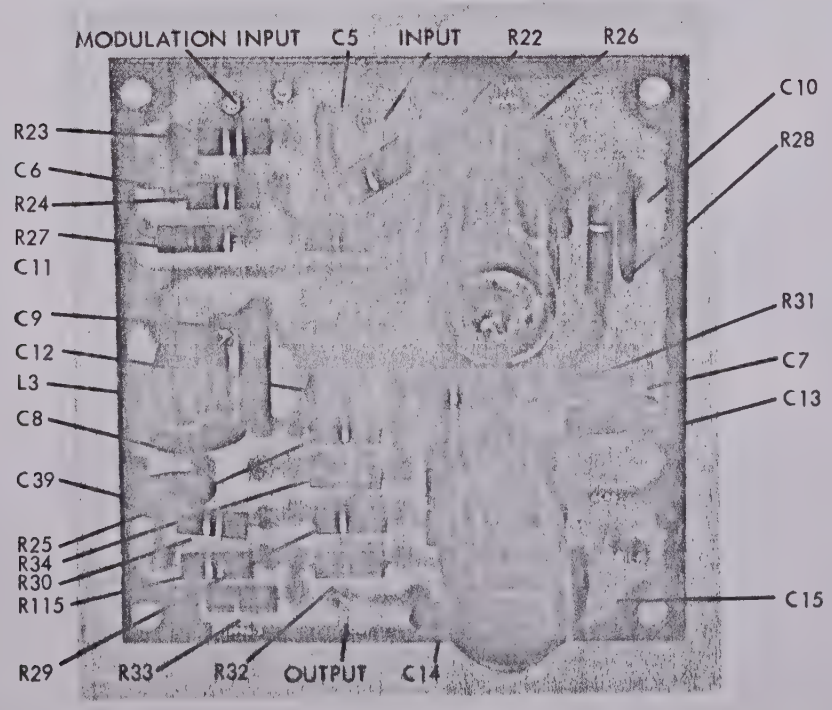
a. Turn off the power. Unsolder all leads coming through the chassis to the stand off terminal labeled TP31, the function selector switch second and third deck (from the panel), B+ and filament tie points.

b. Remove the two 6-32 nuts and threaded spacers holding the board to the stand offs.

6.5.2 Circuit And Typical Voltages



Physical Details:



6.5.3 Typical Resistance Measurement

Using an ohmmeter such as Weston 980 or a 20,000 ohms/volt Multimeter.

Test Point	Resistance*
TP4	Approx. 30K Ω
TP6	250K
TP7	4.7K
TP8	∞

*To Chassis Ground

6.5.4 Typical Harmonic Generation Data

Test Method as indicated in the Calibration Section, Paragraph 5.15.1.

Test frequency 100 KC at 0 dbm
Second harmonic generation 67.5 dbm down, attenuator in -60 position
Third harmonic generation 80 dbm down, attenuator in -60 position
Fourth harmonic generation 90 dbm down, attenuator in -70 position
Fifth harmonic generation 90 dbm down, attenuator in -70 position
Sixth harmonic generation 90 dbm down, attenuator in -70 position

6.5.5 Typical Intermodulation Product Data

Test method as indicated in the Calibration Section, Paragraph 5.15.2.

Test frequencies: f_1 72.5 kc at 0 dbm
f_2 100 kc at 0 dbm

Model 125A attenuator in the -60 db position.

$f_1 + f_2$	172.5 kc	66 dbm down
$f_2 - f_1$	27.5 kc	66 dbm down
$2f_1 - f_2$	45.0 kc	78 dbm down
$2f_1 + f_2$	245.0 kc	80 dbm down
$2f_2 - f_1$	127.5 kc	80 dbm down
$2f_2 + f_1$	272.5 kc	80 dbm down

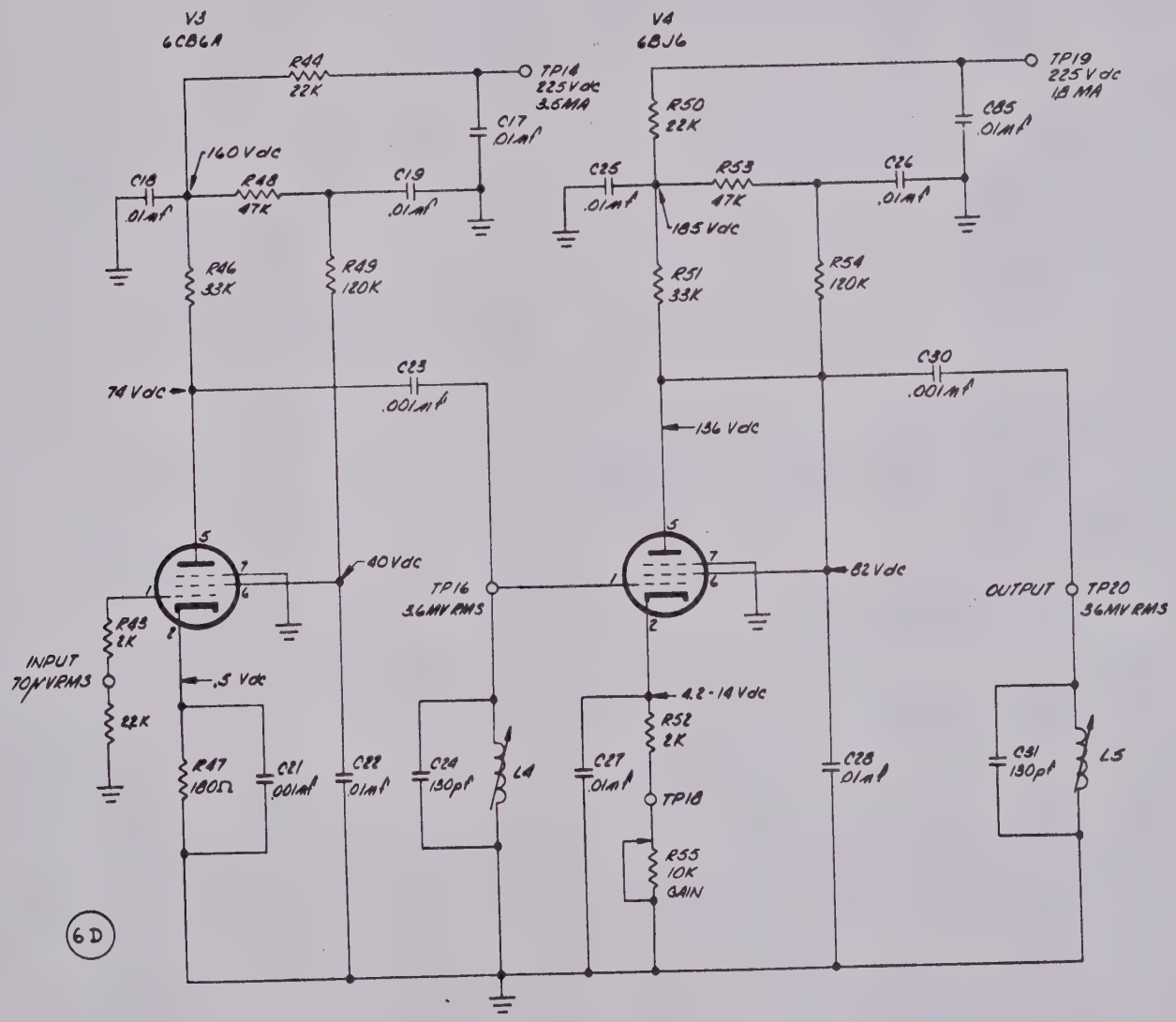
6.6 IF Amplifiers

6.6.1 General

Each IF amplifier stage is assembled on a separate printed board mounted off the chassis by four metallic stand offs. Both stages are shielded by a common cover. The cover is removed by unscrewing the two top thumb screws. Each board is held by two 6-32 nuts and two threaded spacers. To remove the boards, it is necessary to unsolder the b+, filament, input and output leads underneath the chassis.

The amplifiers can be operated with the cover shield removed for test purposes without going into oscillation. Final trimming of inductors L4 and L5 should not be attempted without the cover in place; obviously the proximity will shift the tuning.

6.6.2 Circuit And Typical Voltages



All d-c voltages measured with a high impedance voltmeter such as Hewlett-Packard 410B.

6.6.3 Typical Resistance Measurement

Use an ohmmeter having a 20,000 ohms pervolt sensitivity, such as Weston Model 980.

Test Point	Resistance*
TP 14 and 19	Approx. 30K Ω
TP 13	2.2K (when connected)
TP 15, 16, 20	.11 Ω
TP 18	Short to 10K Ω

*To Chassis Ground

6.7 Flat Voltmeter

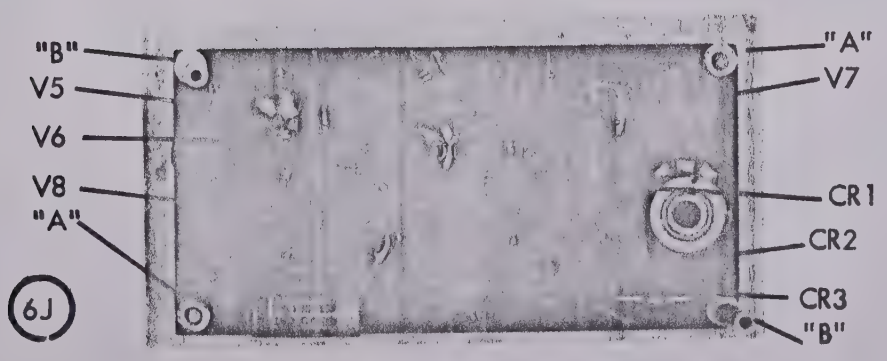
6.7.1 Unit Removal

The complete flat voltmeter circuit is assembled on a printed circuit board mounted at the rear right corner of the chassis. The board is mounted off the chassis on four stand-offs and fastened by two nuts and two threaded spacers. If it is necessary to remove the board from the chassis for servicing proceed as follows:

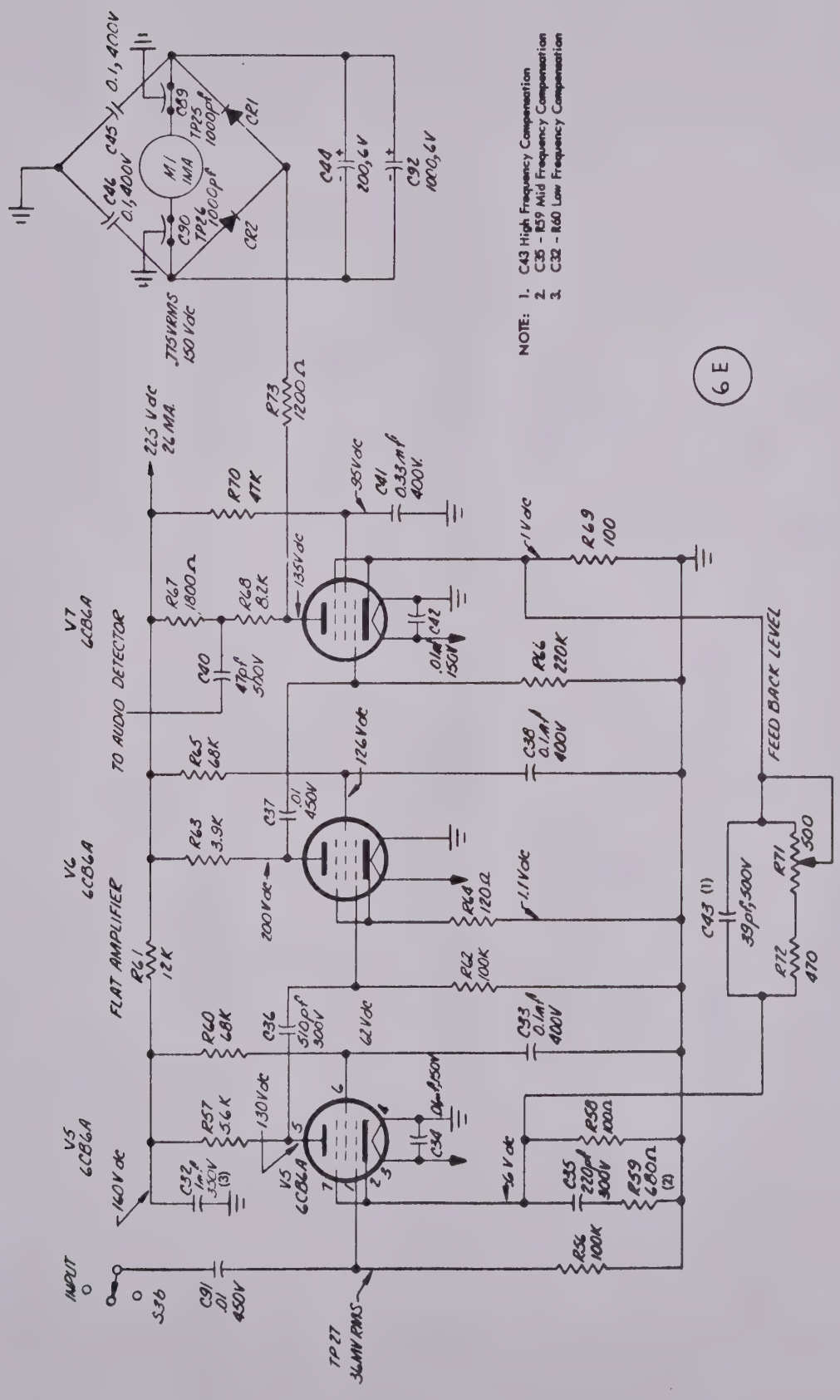
(a) Turn off the power. Unsolder the lead coming through the chassis to the stand-off terminal labeled TP28, underneath the chassis, and also the shielded lead between the board and the function selector switch rear deck.

(b) Remove the two 6-32 nuts "A" and the two threaded spacers "B" holding the board to the stand-offs.

(c) Lift the board off the stand-offs and swing toward the back. The board is connected only to the chassis by its wiring. It can be easily serviced in this position. For complete removal, unsolder the 6 remaining lead connections.



6.7.2 Circuit And Typical Voltages



6.7.3 Part Replacement

When replacing any tubes or components in this circuit, it will be necessary to reset the feedback adjustment R71 as described in the Calibration Section, Paragraph 5.5.1. When replacing the following feedback circuit components C32, C43, C35, R59, it will be required to check the frequency response of the flat voltmeter, as described in the Calibration Section, Paragraph 5.5.2. When replacing the following meter circuit components M1, CR1, CR2, R73, R69, it will be required to check the meter scale linearity as described in the Calibration Section, Paragraph 5.5.3. Replace components only as indicated in list of replaceable parts, the specified items are usually chosen for definite characteristics that may vary in other equivalent products.

6.7.4 Trouble Shooting

CAUTION: The meter terminals of this instrument are at a d-c potential above ground. Any short circuit between these terminals and ground will burn out or damage the meter circuit diodes.

Poor meter scale linearity is usually due to one or both defective diodes. Low plate or screen voltages are commonly caused by defective grid coupling, cathode or screen bypass capacitors.

The frequency response of the flat voltmeter is determined mainly by the following components: R71, R72, C43, C35, R59 and C32. If the low frequency response is poor, check C32 located in the plate circuit of V5. To a lesser degree V5 plate load resistance R57 could be faulty. For the high end of the range check mainly C35 and R59 located in the cathode circuit of V5. For low overall gain, Check individual stage gain for excessive feedback. Microphonics can be caused by poor electrical contact in Function switch, loose or imperfect solder joints.

The output meter decibel scale is correct for either 135 or 600 ohm input impedance. The impedance selector changes and compensates properly the input circuitry so that 0 db is in reference of 1 mW in either impedance, but the voltage scales apply only to the 600 ohm input. The voltage for the 135 ohm input impedance can be obtained by multiplying the meter voltage by .211. Thus, the voltage corresponding to 0 db in reference to 1 mW in 135 ohms is .775 X .211=.367.

6.8 Injection Oscillator

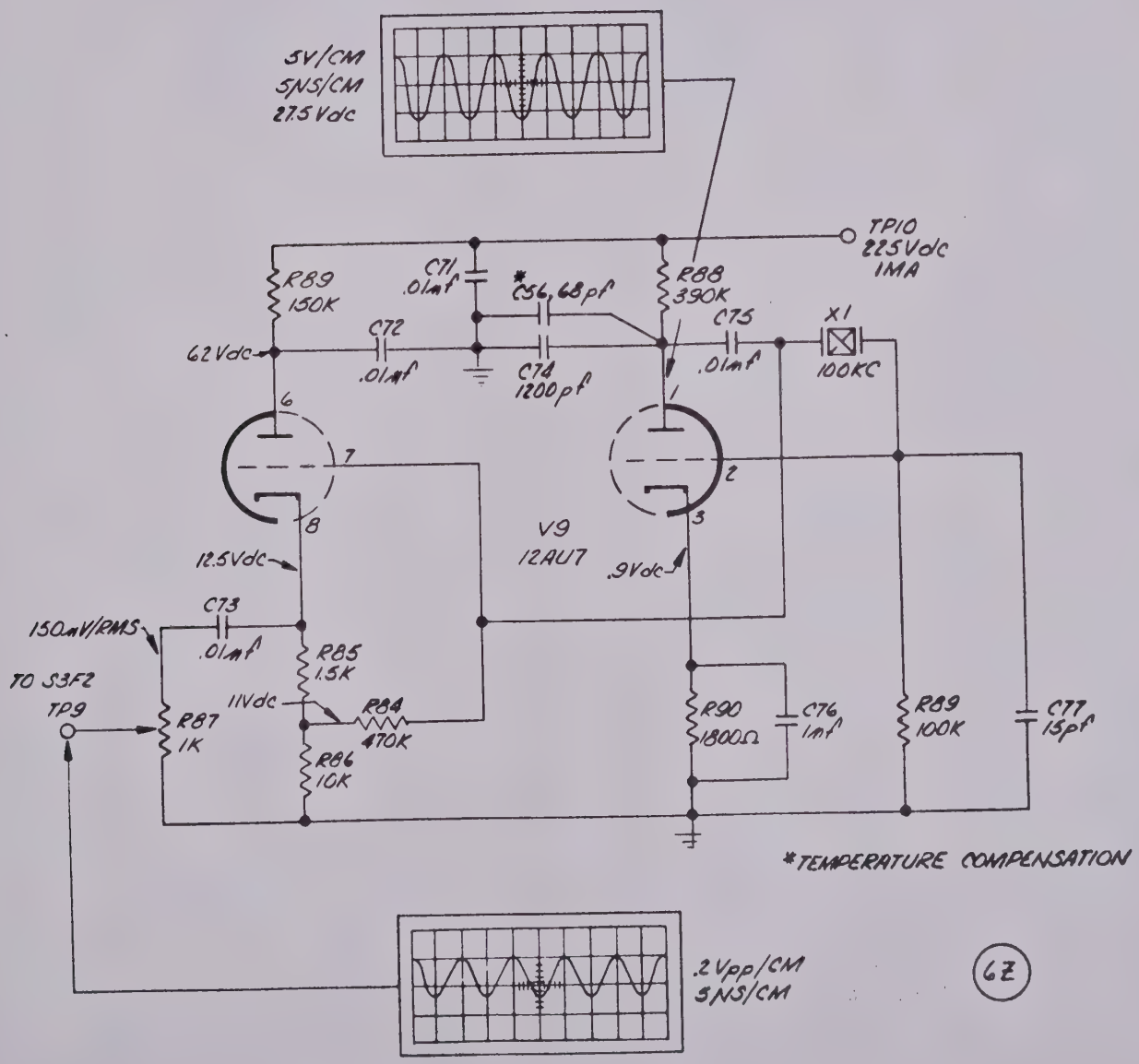
6.8.1 Unit Removal

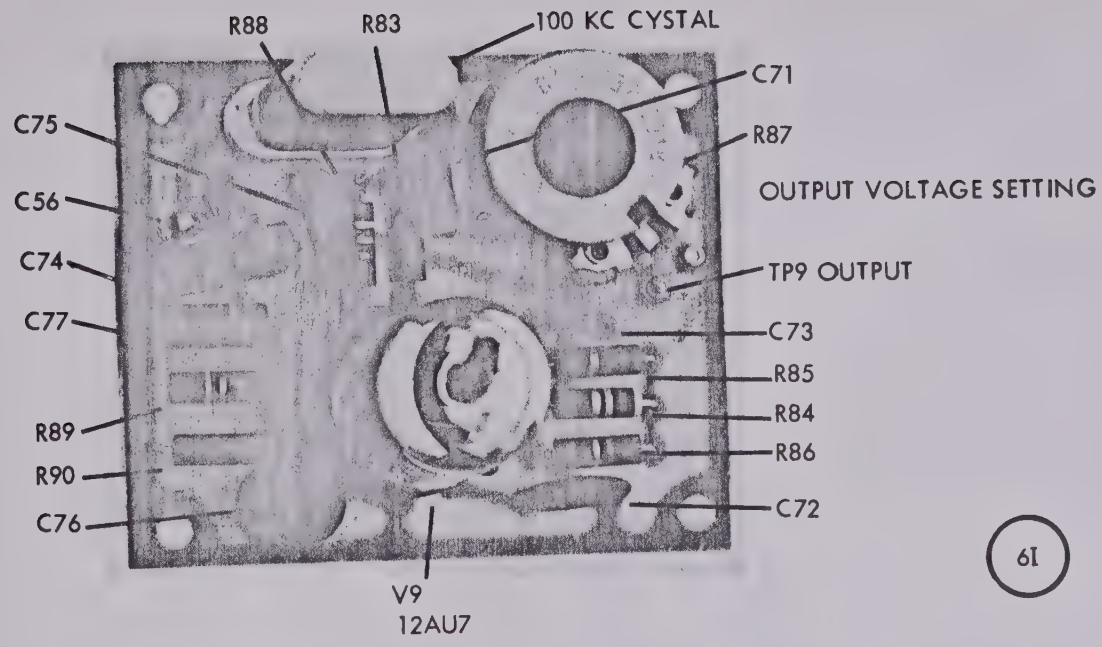
The oscillator circuit is assembled on a printed circuit board mounted at the left rear corner of the chassis, behind the power transformer. It is mounted off the chassis on four metallic stand-offs and fastened to them by two nuts and two threaded spacers. For removal of the board, proceed as follows:

(a) Turn off the power. Unsolder the three leads coming through the chassis to the tie point terminals located immediately below the oscillator area.

(b) Remove the shield. Remove the two 6-32 nuts and the two threaded spacers.

6.8.2 Circuit And Typical Voltages





6.8.3 Oscillator Wave Shape

The typical harmonic content of the 100 kc sinewave oscillator is as follows:

Second	harmonic.	17 db below fundamental
Third	harmonic.	32 db below fundamental
Fourth	harmonic.	42 db below fundamental
Fifth	harmonic.	52 db below fundamental
Sixth	harmonic.	62 db below fundamental

6.9. Input Circuitry

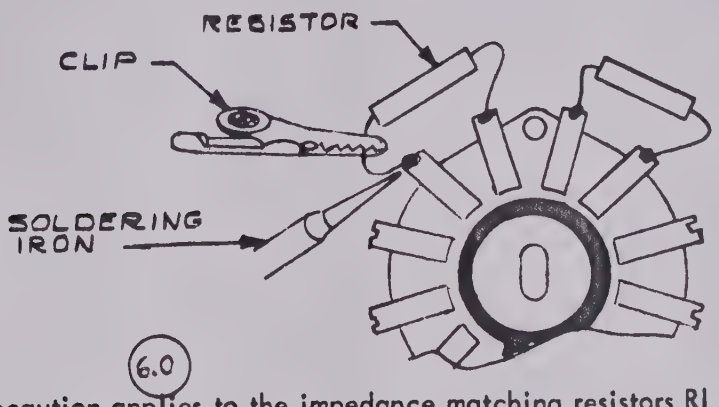
6.9.1 General

No maintenance should be required in this section if proper use of the instrument is observed. The input circuitry includes all the elements between the panel input binding posts and the grid of the mixer stage, namely: bridging transformer, impedance selector, bandpass filter, attenuator switch and function selector switch.

All the contacts and wipers of the switches and their detent mechanism may be checked during overhaul for signs of wear, oxidation, poor contact pressure. Remove dirt and dust from the detent mechanism and lubricate lightly with vaseline or adequate greese. Wipe clean the binding posts feed through insulators.

6.9.2 Part Replacement

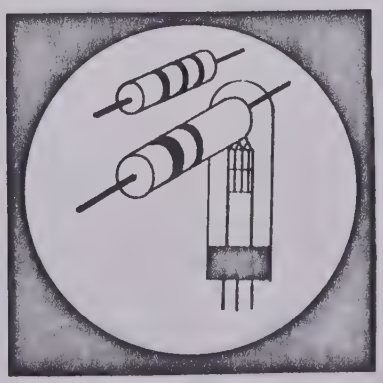
Use only parts list suggested for replacement parts. When replacing resistors on the attenuator switch, avoid overheating the resistors. These resistors are deposited carbon film and very delicate. It is recommended, before soldering, to hold with a plier or set a clip on the lead next to the resistor.



The same precaution applies to the impedance matching resistors R1 and R2 mounted on switch S1.

7.0 LIST OF REPLACEABLE PARTS, SCHEMATICS AND ILLUSTRATIONS

Any changes in the list of replaceable parts will be listed on a production change sheet at the front of this manual.



Schem. Ref.	DESCRIPTION	Sierra Stock No.	Mfgr.	Designation
C1	Capacitor, 2.0 mf, 400Vdcw, Metalized Paper	902410205	CD	MPX4W2
C2	Capacitor, 200 pf, 500Vdcw, ± 2% Silver Mica	902010201	EM	CM-15E-201
C3	Capacitor, 470 pf, 300Vdcw, ± 2% Silver Mica	902070471	EM	CM-15E-471
C4	Capacitor, 200 pf, 300 Vdcw, ± 2% Silver Mica	902070201	EM	CM-15E-201
C5	Capacitor, .01 mf, 150Vdcw, Ceramic	901440103	CTL	DDM-103
C6	Capacitor, .01 mf, 150Vdcw, Ceramic	901440103	CTL	DDM-103
C7	Capacitor, .01 mf, 450Vdcw, Disc Ceramic	901400103	E	811-01
C8	Capacitor, .01 mf, 450Vdcw, Disc Ceramic	901400103	E	811-01
C9	Capacitor, 130 pf, 500Vdcw, ± 2%, Silver Mica	902070131	EM	CM-15E-131
C10	Capacitor, .01 mf, 450Vdcw, Disc Ceramic	901400103	E	811-01
C11	Capacitor, .01 mf, 150Vdcw, Ceramic	901440103	CTL	DDM-103
C12	Capacitor, .001 mf, 500Vdcw, Disc Ceramic	901400102	E	801-.001
C13	Capacitor, .01 mf, 450Vdcw, Disc Ceramic	901400103	E	811-01
C14	Capacitor, .001 mf, 500Vdcw, Disc Ceramic	901400102	E	801-.001
C15	Capacitor, .01 mf, 150Vdcw, Disc Ceramic	901440103	CTL	DDM-103
C16	Capacitor, 4.5-25 pf, Ceramic Trimmer, NPO	903200250	E	TS2A-NPO
C17	Capacitor, .01 mf, 450Vdcw, Disc Ceramic	901400103	E	811-01
C18	Capacitor, .01 mf, 450Vdcw, Disc Ceramic	901400103	E	811-01
C19	Capacitor, .01 mf, 450Vdcw, Disc Ceramic	901400103	E	811-01
C20	Capacitor, .01 mf, 150Vdcw, Ceramic	901440103	CTL	DDM-103
C21	Capacitor, .001 mf, 500Vdcw, Disc Ceramic	901400102	E	801-.001
C22	Capacitor, .01 mf, 450Vdcw, Disc Ceramic	901400103	E	811-01
C23	Capacitor, .001 mf, 500Vdcw, Disc Ceramic	901400102	E	801-.001
C24	Capacitor, 130 pf, 500Vdcw, ± 2% Silver Mica	902070131	EM	CM-15E-131
C25	Capacitor, .01 mf, 450Vdcw, Disc Ceramic	901400103	E	811-01
C26	Capacitor, .01 mf, 450Vdcw, Disc Ceramic	901400103	E	811-01
C27	Capacitor, .01 mf, 150Vdcw, Ceramic	901440103	CTL	DDM-103
C28	Capacitor, .01 mf, 450Vdcw, Disc Ceramic	901400103	E	811-01
C29	Capacitor, .01 mf, 150Vdcw, Ceramic	901440103	CTL	DDM-103
C30	Capacitor, .001 mf, 500Vdcw, Disc Ceramic	901400102	E	801-.001
C31	Capacitor, 130 pf, 500Vdcw, ± 2%, Silver Mica	902070131	EM	CM-15E-131
C32	Capacitor, 1.0 mf, 200 Vdcw, Metalized Mylar	902410105	CD	MPX2W1
C33	Capacitor, .1 mf, 400Vdcw, Paper	901050104	CD	4SE-P10
C34	Capacitor, .01 mf, 150Vdcw, Ceramic	901440103	CTL	DDM-103
C35	Capacitor, 220 pf, 300Vdcw, ± 2% Silver Mica	902070221	EM	CM-15E-221
C36	Capacitor, 510 pf, 300Vdcw, ± 2% Silver Mica	902070511	EM	CM-15E-511G
C37	Capacitor, .01 mf, 450Vdcw, Disc Ceramic	901400103	E	811-01
C38	Capacitor, .1 mf, 400Vdcw, Paper	901050104	CD	4SE-P10
C39	Capacitor, .01 mf, 450Vdcw, Disc Ceramic	901400103	E	811-01
C40	Capacitor, 47 pf, 500Vdcw, ± 2% Silver Mica	902040470	EM	CM-15E-470
C41	Capacitor, .33 mf, 400Vdcw, Paper Tubular	901010334	SP	4SE-P33
C42	Capacitor, .01 mf, 150Vdcw, Ceramic	901440103	CTL	DDM-103

Schematic Diagram No. E-12525-4

Schem. Ref.	DESCRIPTION	Sierra Stock No.	Mfgr.	Designation
C43	Capacitor, 39 mf, 500Vdcw, ± 2%, Silver Mica	902070390	EM	CM-15E-390
C44	Capacitor, 200 mf, 6Vdcw, Electrolytic	902210207	SP	VL-1108
C45	Capacitor, .1 mf, 400Vdcw, Paper	901000001	CD	4SE-P10
C46	Capacitor, .1 mf, 400Vdcw, Paper	901000001	CD	4SE-P10
C47	Capacitor, .005 pf, 150Vdcw, Ceramic	901420502	CTL	DM-502
C48	Capacitor, .01 mf, 150Vdcw, Ceramic	901440103	CTL	DDM-103
C49	Capacitor, 1.0 mf, 50Vdcw, Electrolytic	902220105	SP	VL-1300
C50	Capacitor, .01 mf, 450Vdcw, Disc Ceramic	901400103	E	811-01
C51	Capacitor, .33 mf, 400Vdcw, Paper Tubular	901010334	SP	4SE-P33
C52	Capacitor, 1.0 mf, 200Vdcw, Metalized Paper	902410105	CD	MPX2W1
C53	Capacitor, 39 pf, 500Vdcw, 5%, Mica Silver	902000390	EM	CM-15E-390
C54	Capacitor, 1000 pf, 500Vdcw, Ceramic Feed Thru	902630102	E	327-102
C55	Capacitor, 1000 pf, 500Vdcw, Ceramic Feed Thru	902630102	E	327-102
C56	Capacitor, 68 pf, Ceramic N330 1200 Vdcw	901410680	CTL	TCA-68
C57	Capacitor, 1000 pf, 500Vdcw, Ceramic Feed Thru	902630102	E	327-102
C58	Capacitor, .01 mf, 450Vdcw, Disc Ceramic	901400103	E	811-01
C59	Capacitor, .01 mf, 450Vdcw, Disc Ceramic	901400103	E	811-01
C60	Capacitor, .01 mf, 450Vdcw, Disc Ceramic	901400103	E	811-01
C61	Capacitor, 10 pf, ± 2%, NPO Tubular, Hi Kap	901420100	CTL	TCZ-10
C62	Capacitor, 10-55.7 pf, Variable (SS-12242-1B)	902810555	RCC	-
C63	Capacitor, .07-12 pf, NPO Glass Trimmer	903000120	JFD	VC-11G
C64	Capacitor, 43 pf, ± 2% NPO Tubular Hi Kap	901410430	CTL	TCZ-43
C65	Capacitor, 10 pf, ± 2% Tubular Hi Kap N330	901410100	CTL	TCA-10
C66	Capacitor, 0.7-12 pf, NPO Glass Trimmer	903000120	JFD	VC-11G
C67	Capacitor, 0.7-12 pf, NPO Glass Trimmer	903000120	JFD	VC-11B
C68	Capacitor, 0.7-12 pf, NPO Glass Trimmer	903000120	JFD	VC-11B
C69	Capacitor, 0.7-12 pf, NPO Glass Trimmer	903000120	JFD	VC-11B
C70	Capacitor, 1.0 mf, 200Vdcw, Metalized Paper	902410105	CD	MPX2W1
C71	Capacitor, .01 mf, 450Vdcw, Disc Ceramic	901400103	E	811-01
C72	Capacitor, .01 mf, 450Vdcw, Disc Ceramic	901400103	E	811-01
C73	Capacitor, .01 mf, 150Vdcw, Ceramic	901440103	CTL	DDM-103
C74	Capacitor, 1200 pf, 500Vdcw, ± 2%, Silver Mica	902080132	EM	CM-19E-132
C75	Capacitor, .01 mf, 450Vdcw, Disc Ceramic	901400103	E	811-01
C76	Capacitor, 1.0 mf, 50Vdcw, Electrolytic	902220105	SP	VL-1300
C77	Capacitor, 15 pf, 500Vdcw ± 5%, Silver Mica	902070150	EM	CM-15E-015
C78	Capacitor, 2X.01 mf, 500Vdcw, Ceramic Disc	901450103	CTL	DD3-103
C79	Capacitor, .33 mf, 400Vdcw, Metalized Paper	902410334	CD	MPX-4P33
C80	Capacitor, 40-20 mf, 450Vdcw, Electrolytic	902210402	ILL	UMP-PC-2424
C81	Capacitor, .01 mf, 450Vdcw, Disc Ceramic	901400103	E	811-01
C82	Capacitor, 1.0 mf, 200Vdcw, Metalized Paper	902410105	CD	MPX2W1
C83	Capacitor, 1.0 mf, 200Vdcw, Metalized Paper	902410105	CD	MPX2W1
C84	Capacitor, .01 mf, 450Vdcw, Disc Ceramic	901400103	E	811-01
C85	Capacitor, .01 mf, 450Vdcw, Disc Ceramic	901400103	E	811-01

Schematic Diagram No. E-12525-4

LIST OF REPLACEABLE PARTS

Schem. Ref.	DESCRIPTION	Sierra Stock No.	Mfgr.	Designation
C86	Capacitor, 1000 pf, 500Vdcw, Cer. Feed Thru	902630102	E	327-102
C87	Capacitor, 1000 pf, 500Vdcw, Ceramic Feed Thru	902630102	E	327-102
C88	Capacitor, 1000 pf, 500Vdcw, Ceramic Feed Thru	902630102	E	327-102
C89	Capacitor, 1000 pf, 500Vdcw, Ceramic Feed Thru	902630102	E	327-102
C90	Capacitor, 1000 pf, 500Vdcw, Ceramic Feed Thru	902630102	E	327-102
C91	Capacitor, .01 mf, 450Vdcw, Disc Ceramic	901400103	E	811-01
C92	Capacitor, 1000 mf, 6Vdcw, Electrolytic	902230108	PY	TD-1006-6
C93	Capacitor, .01 mf, 150Vdcw, Ceramic	901440103	CTL	DDM-103
C94	Capacitor, .01 mf, 450Vdcw, Ceramic	901400103	E	811-01
C95	Capacitor, 50 pf, 500Vdcw ± 2% Silver Mica	902070500	EM	CM15-E-500
CR1	Diode, 1N34A Germanium	910501534	SY	1N34A
CR2	Diode, 1N34A Germanium	910501534	SY	1N34A
CR3	Diode, 1N34A Germanium	910501534	SY	1N34A
CR4	Diode, DR-672 Silicon, High Conduction	910500672	RR	DR-672
CR5	Diode, DR-672 Silicon, High Conduction	910500672	RR	DR-672
CR6	Diode, 1N34A Germanium	910501534	SY	1N34A
CR7	Rectifier, 600 PIV, 500 ma	910800006	TEX	1N2071
CR8	Rectifier, 600 PIV, 500 ma	910800006	TEX	1N2071
CR9	Rectifier, 600 PIV, 500 ma	910800006	TEX	1N2071
CR10	Rectifier, 600 PIV, 500 ma	910800006	TEX	1N2071
DS1	Pilot Light, Bayonet Base	913800001	NU	No. 47
F1	Fuse, 1.0 Amp. Slo-Blo.	913200013	LF	313001
FL1	Crystal Filter, 2.215 mc, 250 cycle Bandpass	910100004	HY	2215 KB
FL2	Crystal Filter, 2.215 mc, 2800 cycle Bandpass	910100005	HY	2215 KA
L1	Inductor, 390 microhenries	909000094	S	SS-11778-1
L2	Inductor, 390 microhenries	909000094	S	SS-11778-1
L3	Inductor, 64-105 microhenries, Variable	909400039	S	SS-12756-1
L4	Inductor, 64-105 microhenries, Variable	909400039	S	SS-12756-1
L5	Inductor, 64-105 microhenries, Variable	909400039	S	SS-12756-1
L6	Inductor, 100 microhenries	909000098	JM	J-301-100
L7	Inductor, 30 microhenries 1.5 amp	909000096	S	SS-12797-1
L8	Inductor, 640 microhenries 3%	909000015	S	SS-4493-1
L9	Inductor, 640 microhenries 3%	909000015	S	SS-4493-1
L10	Inductor, 24 microhenries, 300 ma	909000097	M	4626
L11	Inductor, 20-41 microhenries	909400038	S	SS-12755-1
L12	Inductor, 640 microhenries	909000015	S	SS-4493-1
L13	Inductor, 30 microhenries, 1.5 amp 10%	909000096	S	SS-12797-1
M1	Meter, 0-1.0 ma d-c, Special Scale	911800026	PH	-

Schematic Diagram No. E-12525-4

Schem. Ref.	DESCRIPTION	Sierra Stock No.	Mfgr.	Designation
P1	Power Cord, 10 feet, Molded Plug	916400002	CO	3533
R1	Resistor, 1000 ohm ± 1%, .5W Deposited Carbon	907400080	EL	DC-1/2C
R2	Resistor, 893 ohm ± 1%, .5W Deposited Carbon	907400081	EL	DC-1/2C
R3	Resistor, 980.2 ohm ± 1%,.5W Deposited Carbon	907400088	EL	DC-1/2C
R4	Resistor, 980.2 ohm ± 1%, .5W Deposited Carbon	907400088	EL	DC-1/2C
R5	Resistor, 20.2 ohm ± 1%, .5W Deposited Carbon	907400083	EL	DC-1/2C
R6	Resistor, 938.7 ohm ± 1%,.5W Deposited Carbon	907400086	EL	DC-1/2C
R7	Resistor, 938.7 ohm ± 1%,.5W Deposited Carbon	907400086	EL	DC-1/2C
R8	Resistor, 63.31 ohm ± 1%,.5W Deposited Carbon	907400087	EL	DC-1/2C
R9	Resistor, 818.2 ohm ± 1%,.5W Deposited Carbon	907400084	EL	DC-1/2C
R10	Resistor, 818.2 ohm ± 1%,.5W Deposited Carbon	907400084	EL	DC-1/2C
R11	Resistor, 202.0 ohm ± 1%,.5W Deposited Carbon	907400085	EL	DC-1/2C
R12	Resistor, 519.4 ohm ± 1%,.5W Deposited Carbon	907400082	EL	DC-1/2C
R13	Resistor, 519.4 ohm ± 1%,.5W Deposited Carbon	907400082	EL	DC-1/2C
R14	Resistor, 702.7 ohm ± 1%,.5W Deposited Carbon	907400092	EL	DC-1/2C
R15	Resistor, 683.8 ohm ± 1%,.5W Deposited Carbon	907400022	EL	DC-1/2C
R16	Resistor, 216.2 ohm ± 1%,.5W Deposited Carbon	907400020	EL	DC-1/2C
R17	Resistor, 68.38 ohm ± 1%,.5W Deposited Carbon	907400018	EL	DC-1/2C
R18	Resistor, 21.62 ohm ± 1%,.5W Deposited Carbon	907400017	EL	DC-1/2C
R19	Resistor, 6.838 ohm ± 1%,.5W Deposited Carbon	907400089	EL	DC-1/2C
R20	Resistor, 2.162 ohm ± 1%,.5W Deposited Carbon	907400090	EL	DC-1/2C
R21	Resistor, 1.000 ohm ± 1%,.5W Deposited Carbon	907400091	EL	DC-1/2C
R22	Resistor, 68 ohm ± 10%, .5W Fixed Composition	905200680	AB	EB
R23	Resistor, 100,000 ohm ± 10%,.5W Fixed Composition	905200104	AB	EB
R24	Resistor, 150,000 ohm ± 10%,.5W Fixed Composition	905200154	AB	EB
R25	Resistor, 1,000 ohm ± 5%, .5W Fixed Composition	905000102	AB	EB
R26	Resistor, 220 ohm ± 5%, .5W Fixed Composition	905000221	AB	EB
R27	Resistor, 4700 ohm ± 5%,.5W Fixed Composition	905000472	AB	EB
R28	Resistor, 39,000 ohm ± 5%, .5W Fixed Composition	905000393	AB	EB
R29	Resistor, 27 ohm ± 10%, .5W Fixed Composition	905200270	AB	EB
R30	Resistor, 100,000 ohm ± 10%, .5W Fixed Composition	905200104	AB	EB
R31	Resistor, 68,000 ohm ± 10%, .5W Fixed Composition	905200683	AB	EB
R32	Resistor, 220 ohm ± 5%, .5W Fixed Composition	905000221	AB	EB
R33	Resistor, 820 ohm ± 5%, .5W Fixed Composition	905000821	AB	EB
R34	Resistor, 2,700 ohm ± 5%, .5W Fixed Composition	905000272	AB	EB
R35	Resistor, 3,000 ohm ± 5%, .5W Fixed Composition	905000302	AB	EB
R36	Resistor, 3,900 ohm ± 5%, .5W Fixed Composition	905000392	AB	EB
R37	Resistor, 4,700 ohm ± 5%, .5W Fixed Composition	905000472	AB	EB
R38	Resistor, 1800 ohm ± 5%,.5W Fixed Composition	905000182	AB	EB
R39	Resistor, 2,200 ohm ± 5%,.5W Fixed Composition	905000222	AB	EB
R40	Resistor, 1800 ohm ± 5%,.5W Fixed Composition	905000182	AB	EB
R41	Resistor, 1800 ohm ± 5%,.5W Fixed Composition	905000182	AB	EB
R42	Potentiometer 500 ohm, 2W Composition	907900020	S	SS-393-3-20

Schematic Diagram No. E-12525-4

Schem. Ref.	DESCRIPTION		Sierra Stock No.	Mfgr.	Designation
R43	Resistor, 2000 ohm, ± 5%, .5W	Fixed Composition	905000202	AB	EB
R44	Resistor, 22,000 ohm, ± 10%, .5W	Fixed Composition	905200223	AB	EB
R45	Not Used				
R46	Resistor, 33,000 ohm, ± 10%, .5W	Fixed Composition	905200333	AB	EB
R47	Resistor, 180 ohm, ± 5%, .5W	Fixed Composition	905000181	AB	EB
R48	Resistor, 47,000 ohm, ± 10%, .5W	Fixed Composition	905200473	AB	EB
R49	Resistor, 120,000 ohm, ± 10%, .5W	Fixed Composition	905200124	AB	EB
R50	Resistor, 22,000 ohm, ± 10%, .5W	Fixed Composition	905200223	AB	EB
R51	Resistor, 33,000 ohm, ± 10%, .5W	Fixed Composition	905200333	AB	EB
R52	Resistor, 2,000 ohm, ± 5%, .5W	Fixed Composition	905000202	AB	EB
R53	Resistor, 47,000 ohm, ± 10%, .5W	Fixed Composition	905200473	AB	EB
R54	Resistor, 120,000 ohm, ± 10% .5W	Fixed Composition	905200124	AB	EB
R55	Potentiometer, 10,000 ohm, 2W	Composition	907900037	S	SS-393-3-37
R56	Resistor, 100,000 ohm ± 10%, .5W	Fixed Composition	905200104	AB	EB
R57	Resistor, 5,600 ohm ± 10%, .5W	Fixed Composition	905200562	AB	EB
R58	Resistor, 100 ohm ± 5%, .5W	Fixed Composition	905000101	AB	EB
R59	Resistor, 680 ohm ± 5%, .5W	Fixed Composition	905000681	AB	EB
R60	Resistor, 68,000 ohm ± 10%, .5W	Fixed Composition	905200683	AB	EB
R61	Resistor, 12,000 ohm ± 10%, .5W	Fixed Composition	905200123	AB	EB
R62	Resistor, 100,000 ohm ± 10%, .5W	Fixed Composition	905200104	AB	EB
R63	Resistor, 3,900 ohm ± 10%, .5W	Fixed Composition	905200393	AB	EB
R64	Resistor, 120 ohm ± 5%, .5W	Fixed Composition	905000121	AB	EB
R65	Resistor, 68,000 ± 10%, .5W	Fixed Composition	905200683	AB	EB
R66	Resistor, 220,000 ohm ± 10%, .5W	Fixed Composition	905200224	AB	EB
R67	Resistor, 1800 ohm ± 5%, .5W	Fixed Composition	905000182	AB	EB
R68	Resistor, 8,200 ohm ± 5%, .5W	Fixed Composition	905000822	AB	EB
R69	Resistor, 100 ohm ± 5%, .5W	Fixed Composition	905000101	AB	EB
R70	Resistor, 47,000 ohm ± 10%, .5W	Fixed Composition	905200473	AB	EB
R71	Potentiometer, 500 ohm, .5W, Taper,	PC Type	907900101	S	SS-393-3-45
R72	Resistor, 470 ohm ± 5%, .5W	Fixed Composition	905000471	AB	EB
R73	Resistor, 1,200 ohm ± 10%, .5W	Fixed Composition	905200122	AB	EB
R74	Resistor, 1,000 ohm ± 10%, .5W	Fixed Composition	905200102	AB	EB
R75	Resistor, 470,000 ohm ± 10%, .5W	Fixed Composition	905200474	AB	EB
R76	Resistor, 100,000 ohm ± 10%, .5W	Fixed Composition	905200104	AB	EB
R77	Resistor, 2,700 ohm ± 5%, .5W	Fixed Composition	905000272	AB	EB
R78	Resistor, 470,000 ohm ± 10%, .5W	Fixed Composition	905200474	AB	EB
R79	Resistor, 47,000 ohm ± 10%, .5W	Fixed Composition	905200473	AB	EB
R80	Resistor, 560 ohm ± 5%, .5W	Fixed Composition	905000561	AB	EB
R81	Resistor, 10,000 ohm ± 10%, .5W	Fixed Composition	905200103	AB	EB
R82	Potentiometer, 100,000 ohm, 2W Composition, Switch, Section		907900071	S	SS-393-3-45
R83	Resistor, 150,000 ohm ± 5%, .5W	Fixed Composition	905000154	AB	EB
R84	Resistor, 470,000 ohm ± 10%, .5W	Fixed Composition	905200474	AB	EB
R85	Resistor, 1500 ohm ± 5%, .5W	Fixed Composition	905000152	AB	EB

Schematic Diagram No. E-12525-4

Schem. Ref.	DESCRIPTION	Sierra Stock No.	Mfgr.	Designation
R86	Resistor, 10,000 ohm ± 10%, .5W Fixed Composition	905200103	AB	EB
R87	Potentiometer, 1,000 ohm, .5W, Taper 1, PC Type	907900101	ST	LH61
R88	Resistor, 390,000 ohm ± 5%, .5W Fixed Composition	905000394	AB	EB
R89	Resistor, 100,000 ohm, ± 10%, .5W Fixed Composition	905200104	AB	EB
R90	Resistor, 1800 ohm, ± 5%, .5W Fixed Composition	905000182	AB	EB
R91	Resistor, 2,000 ohm ± 5%, .5W Fixed Composition	905000202	AB	EB
R92	Resistor, 1 Meg ohm ± 10%, .5W Fixed Composition	905200105	AB	EB
R93	Resistor, 1,000 ohm ± 5%, .5W Fixed Composition	905000102	AB	EB
R94	Resistor, 47,000 ohm ± 5%, .5W Fixed Composition	905000473	AB	EB
R95	Resistor, 100,000 ohm ± 10%, .5W Fixed Composition	905200104	AB	EB
R96	Resistor, 9,100 ohm ± 5%, .5W Fixed Composition	905000912	AB	EB
R97	Resistor, 1,000 ohm ± 5%, .5W Fixed Composition	905000102	AB	EB
R98	Resistor, 150 ohm ± 5%, .5W Fixed Composition	905000151	AB	EB
R99	Resistor, 150 ohm ± 5%, .5W Fixed Composition	905000151	AB	EB
R100	Potentiometer, 500 ohm, .25W Composition(Lug Term.)	907900102	AB	R
R101	Resistor, 270 ohm ± 5%, .5W Fixed Composition	905000271	AB	EB
R102	Resistor, 270 ohm ± 5%, .5W Fixed Composition	905000271	AB	EB
R103	Resistor, 100,000 ohm ± 5%, .5W Fixed Composition	905000104	AB	EB
R104	Resistor, 100,000 ohm ± 5%, .5W Fixed Composition	905000104	AB	EB
R105	Resistor, 220 ohm ± 10%, .5W Fixed Composition	905200221	AB	EB
R106	Resistor, 39 ohm ± 10%, .5W Fixed Composition	905200390	AB	EB
R107	Resistor, 560,000 ohm ± 5%, .5W Fixed Composition	905000564	AB	EB
R108	Resistor, 15,000 ohm ± 5%, 2W Fixed Composition	905800153	AB	HB
R109	Resistor, 22,000 ohm ± 5%, 2W Fixed Composition	905800223	AB	EB
R110	Resistor, 560,000 ohm ± 5%, .5W Fixed Composition	905000564	AB	EB
R111	Resistor, 68,000 ohm ± 5%, 1W Fixed Composition	905400683	AB	GB
R112	Resistor, 47,000 ohm ± 5%, 1W Fixed Composition	905400473	AB	GB
R113	Potentiometer, 25,000 ohm, Taper 1, PC Type	907900103	ST	LH61
R114	Resistor, 10,000 ohm, -5%, .5W Fixed Composition	905000103	AB	EB
R115	Resistor, 220,000 ± 10%, .5W Fixed Composition	905200224	AB	EB
S1	Switch, Selector, 3 pole, 2 Position, One Section	911200047	CTL	1407
S2	Switch, Selector, 3 pole, 11 Position, Four Section	911200045	S	SS-12454-1
S3	Switch, Selector, 9 pole, 5 Position, Six Section	911200046	S	SS-12455-1
S4	Switch, On-Off, (Part of R82 Potentiometer)	907900071	S	SS-393-3-45
T1	Transformer, 600-135 ohm/2000 ohm, 1 to 600 kc	910200003	S	SS-10490-1
T2	Transformer, 2:1 turns ratio, Frequency 2.2 to 2.9 mc	910200004	S	SS-12493-1
T3	Transformer, Power, Sec.#1 268 Vrms @ 75 ma: Sec.#2 6.3 Vrms @ 3.5A Sec.#3 6.3 Vrms @1.6A, Primary 117 Vrms 50/60 cps	910000033	S	SS-12403-1A

Schematic Diagram No. E-12525-4

LIST OF REPLACEABLE PARTS

Schem. Ref.	DESCRIPTION	Sierra Stock No.	Mfgr.	Designation
V1	Vacuum Tube, Sharp cut-off pentode	910700074	P	6AH6
V2	Vacuum Tube, Sharp cut-off pentode	910700059	P	6CB6A
V3	Vacuum Tube, Sharp cut-off pentode	910700059	P	6CB6A
V4	Vacuum Tube, Sharp cut-off pentode	910700075	P	6BJ6
V5	Vacuum Tube, Sharp cut-off pentode	910700059	P	6CB6A
V6	Vacuum Tube, Sharp cut-off pentode	910700059	P	6CB6A
V7	Vacuum Tube, Sharp cut-off pentode	910700059	P	6CB6A
V8	Vacuum Tube, Twin Triode	910700052	P	12AU7
V9	Vacuum Tube, Twin Triode	910700052	P	12AU7
V10	Vacuum Tube, Twin Triode	910700052	P	12AU7
V11	Vacuum Tube, Pentode	910700076	P	6AV5GA
V12	Vacuum Tube, Twin Triode	910700069	P	12AX7
V13	Gas Tube, Voltage Reference	910700015	P	5651
XD	Pilot Light, Holder	914200008	D	7-04
XF1	Fuse Holder	913400001	LF	342003
XV1	Tube Socket, 7 pin min. for printed board	914000036	CH	53P20682
XV2	Tube Socket, 7 pin min. for printed board	914000036	CH	53P20682
XV3	Tube Socket, 7 pin min. for printed board	914000036	CH	53P20682
XV4	Tube Socket, 7 pin min. for printed board	914000036	CH	53P20682
XV5	Tube Socket, 7 pin min. for printed board	914000036	CH	53P20682
XV6	Tube Socket, 7 pin min. for printed board	914000036	CH	53P20682
XV7	Tube Socket, 7 pin min. for printed board	914000036	CH	53P20682
XV8	Tube Socket, 9 pin Noval for printed board	914000037	CH	44P20686
XV9	Tube Socket, 9 pin Noval for printed board	914000037	CH	44P20686
XV10	Tube Socket, Turret	914000032	V	8N12T
XV11	Tube Socket, Octal for printed board	914000035	EC	611PH-1/16
XV12	Tube Socket, 9 pin Noval for printed board	914000037	CH	44P20686
XV13	Tube Socket, 7 pin min. for printed board	914000036	CH	53P20682
Y1	Crystal, Quartz 100 kc, .02%	912200009	BL	100 kc
YX1	Crystal, Holder, Ceramic	914200021	JH	126-105
-	Miscellaneous Items - See Page 64			

Schematic Diagram No. E-12525-4

LIST OF REPLACEABLE PARTS

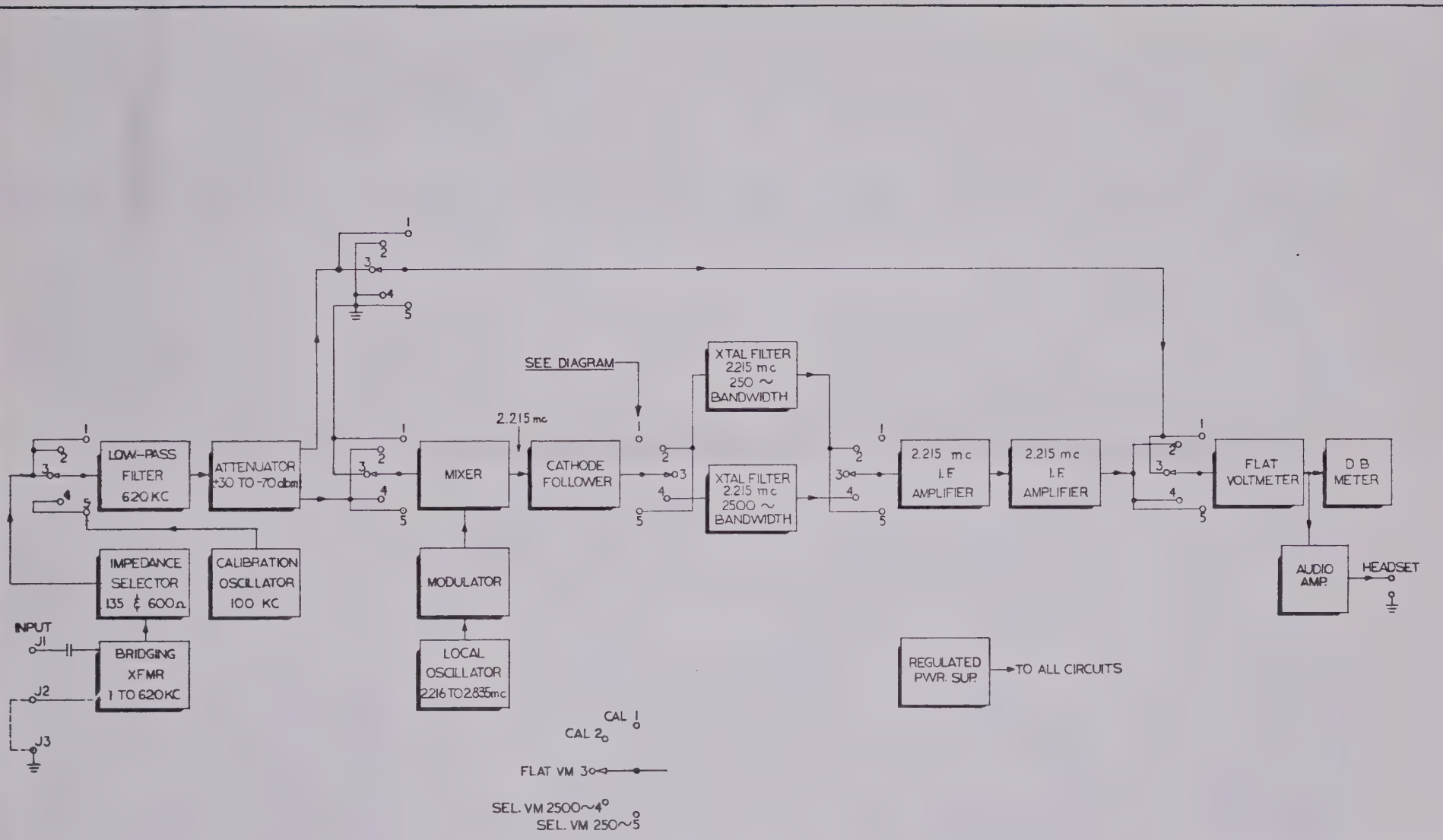
MISCELLANEOUS ITEMS

DESCRIPTION	Sierra Stock No.	Mfgr.	Designation
Binding Post, Insulated	915200003	GR	938-C
Binding Post, Grounded	915200004	GR	938-WB
Shorting Link	915200007	GR	938-L
Board, Printed Circuit, Mixer	904500003	S	-
Board, Printed Circuit, IF Amplifier, 1st Stage	904500004	S	-
Board, Printed Circuit, IF Amplifier, 2nd Stage	904500005	S	-
Board, Printed Circuit, Flat Voltmeter	904500006	S	-
Board, Printed Circuit, Injection Oscillator	904500007	S	-
Cabinet	-	S	SU-12328-4
Cover, Mixer	-	S	SP-12582-3
Cover, IF	-	S	SP-12352-3
Cover, Flat Voltmeter	-	S	SP-12579-3
Cover, Injection Oscillator	-	S	SP-12329-3
Knob, Impedance Selector	916000036	S	-
Knob, Function Switch	916000038	S	-
Knob, Attenuator	916000036	S	-
Knob, IF Gain	916000037	S	-
Knob, Audio Gain	916000037	S	-
Knob, Dial Drive	916000037	S	-
Shield, Function Switch		S	SP-12327-3

Schematic Diagram No. E-12525-4

ABBREVIATIONS FOR MANUFACTURERS

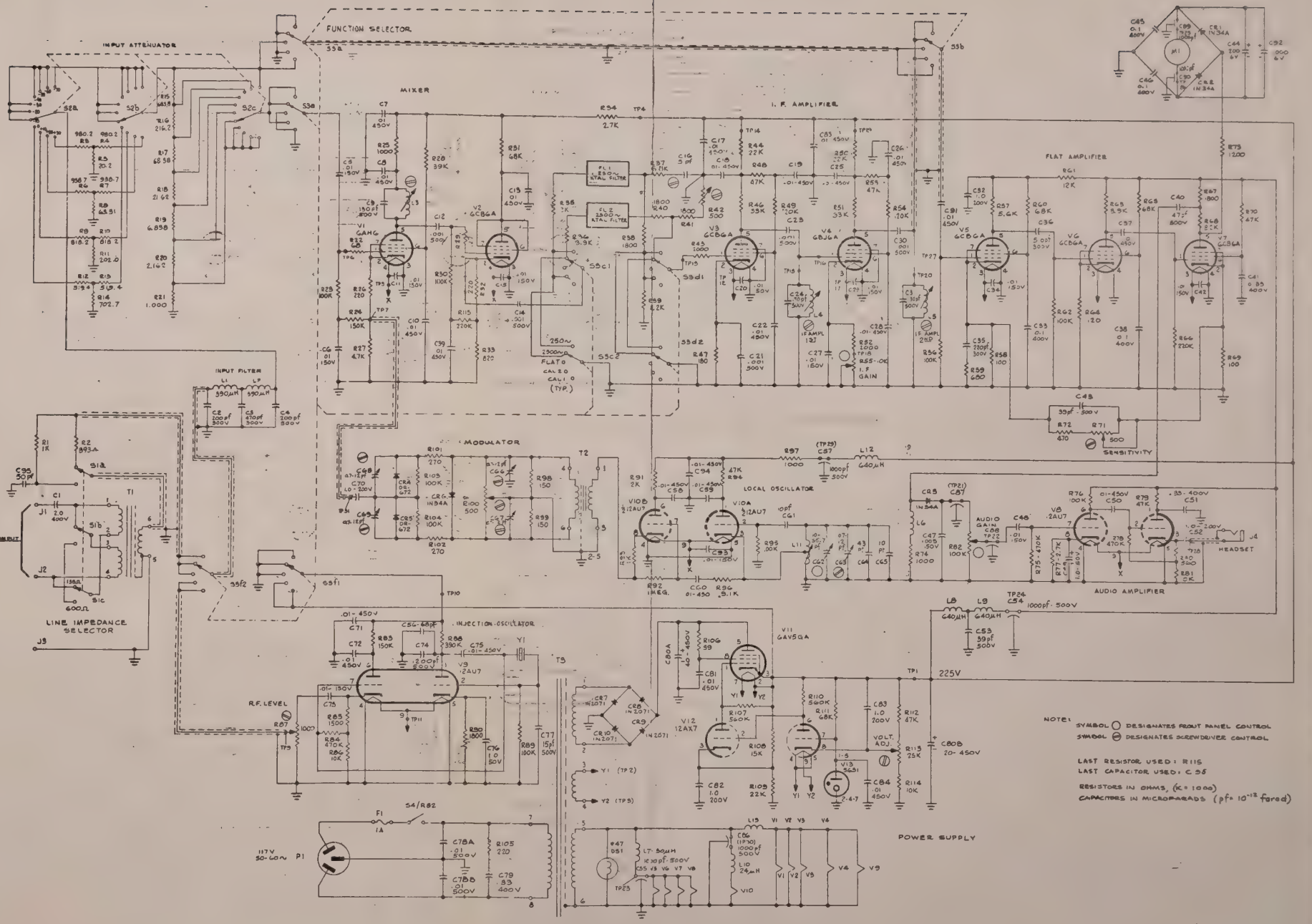
AB	Allen Bradley
BL	Bliley Electric Co.
CD	Cornell-Dubilier
CH	Cinch Mfg. Co.
CO	Cornish Wire Co.,Inc.
CTL	Centralab
D	Dial Co.
E	Erie Resistor Corp.
EC	Elco Sales Co.
EL	Electra
EM	Elmenco-Arco Electronics Inc.
F	Foster
GR	General Radio
HY	Hycon
ILL	Illinois Condenser Co.
JFD	JFD Electronic Corp.
JH	Johnson Co., E.F.
JM	J. Miller
LF	Littlefuse
M	Miller
NU	National Union
P	Philco
PH	Phaostron Instrument Co.
PY	Pyramid Electric Co.
RCC	Radio Condenser Corp.
RR	Radio Receptor
S	Sierra Electronic Corp.
SG	Sangamo
SP	Sprague Products Co.
ST	Stackpole
SY	Sylvania
TEX	Texas Instrument
V	Vector Electronic Co.



FUNCTION SELECTOR SWITCH SHOWN IN FLAT VOLTMETER POSITION
(TYPICAL 6 PLACES)

FIGURE 2

BLOCK DIAGRAM
113 A VOLTMETER
C.L.H. 2-24-60
E-12830-4-A



(E-12525-5 D)

Figure 3. Schematic Diagram, Frequency Selective Voltmeter

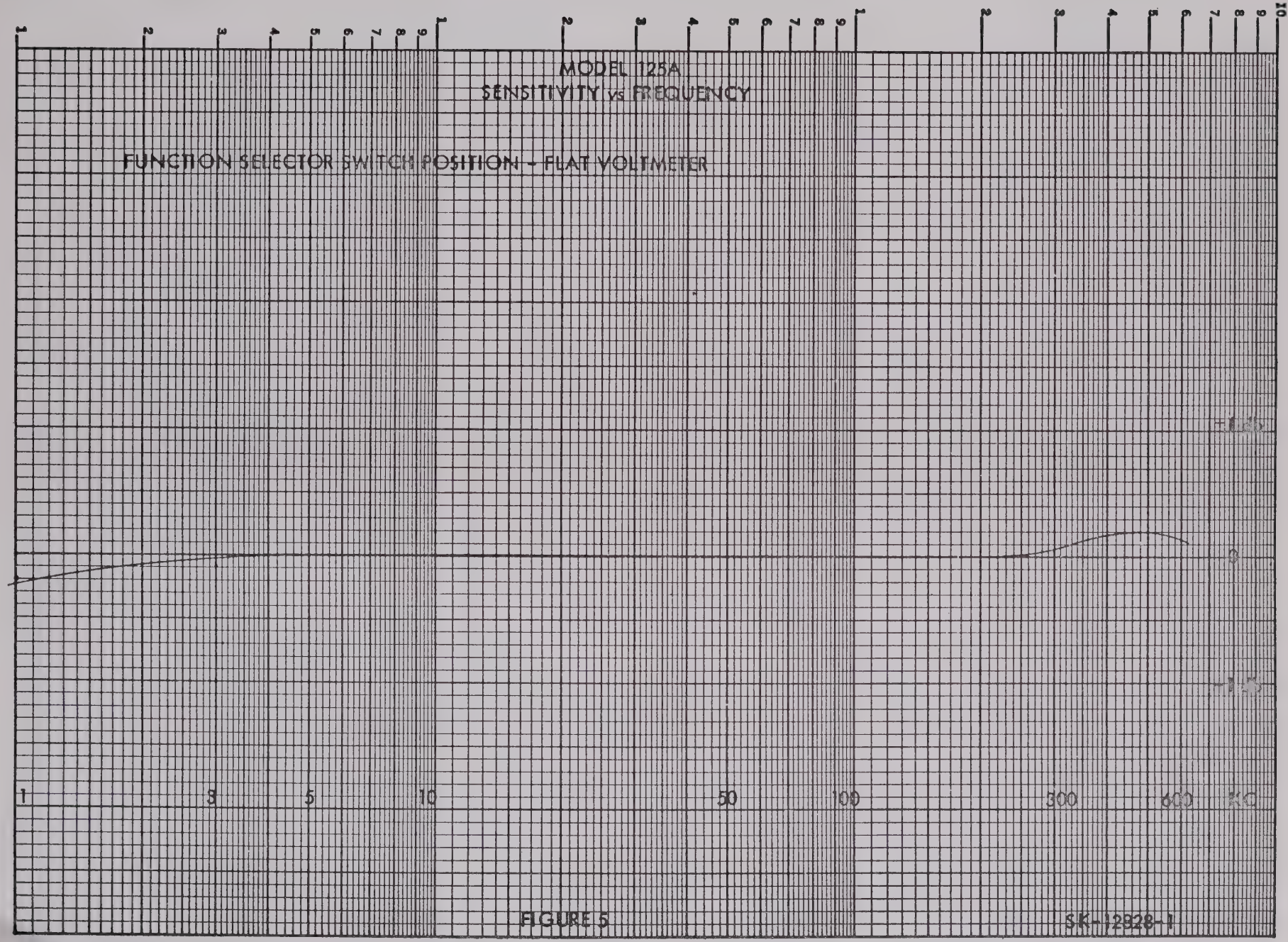


FIGURE 5

SK-12828-1

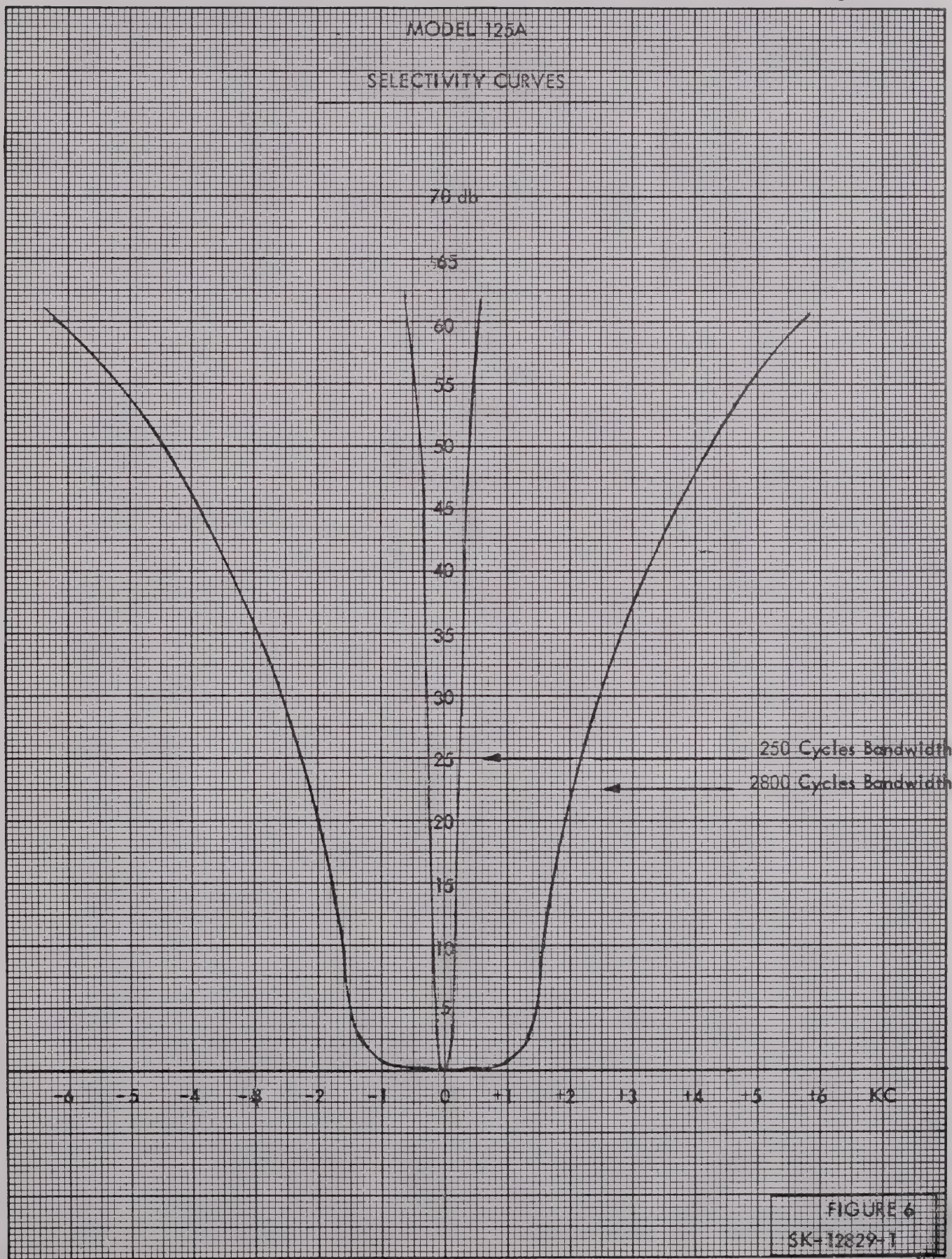


FIGURE 6
SK-12829-T

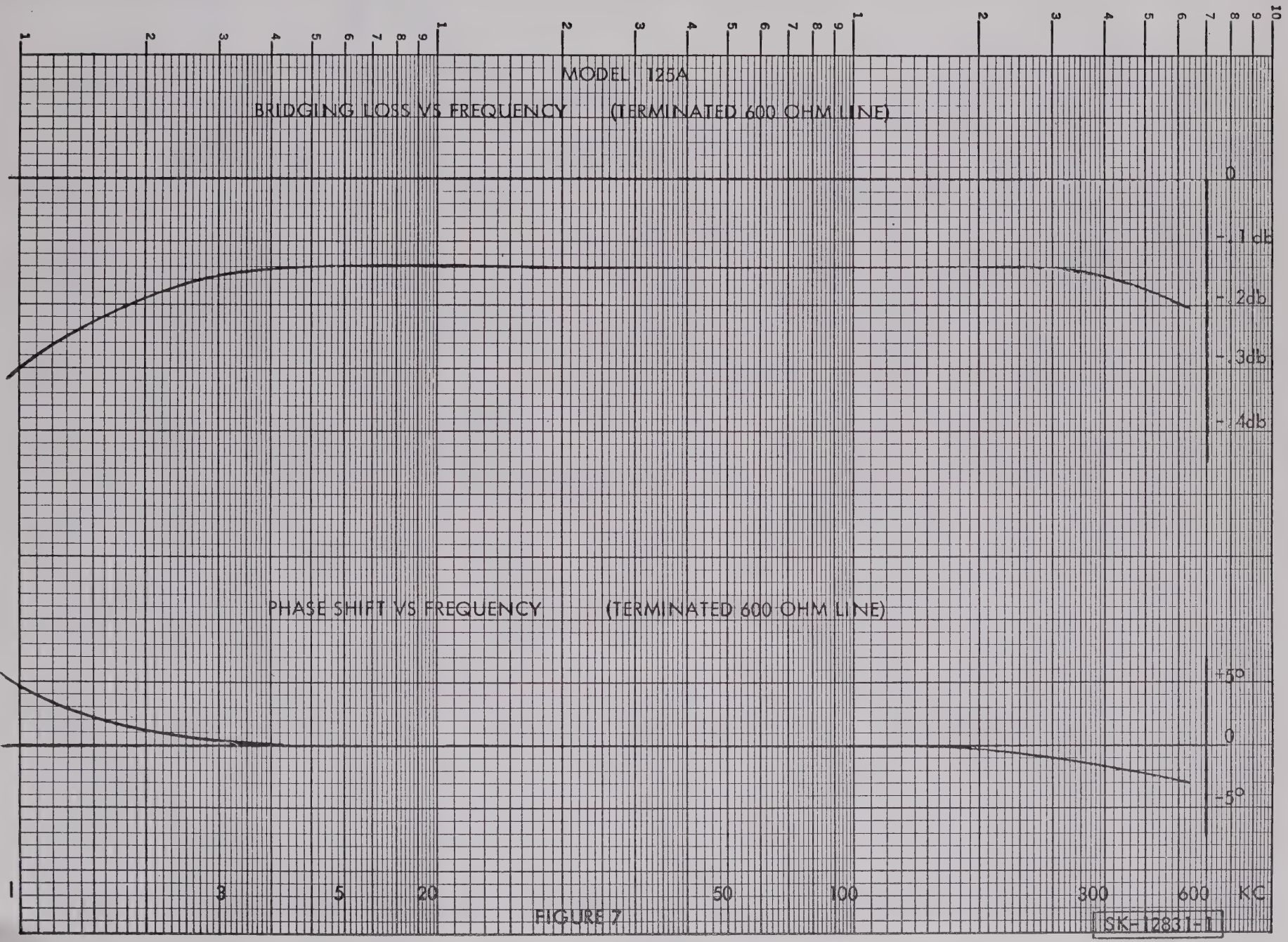


FIGURE 7

SK-12831-1

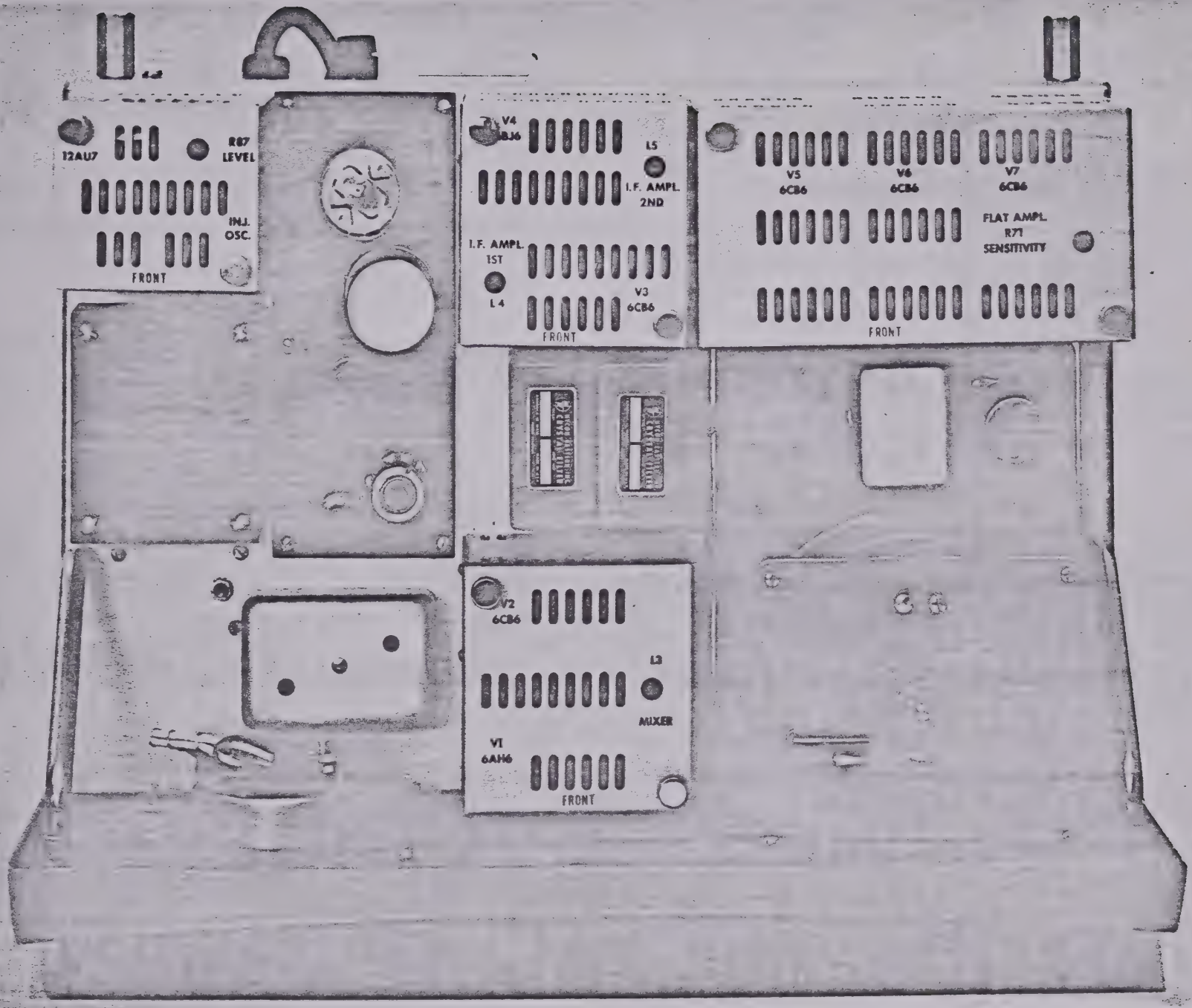

12AU7
R87
LEVEL
INJ.
OSC.
FRONT
V4
6BJ6
L5
I.F. AMPL.
2ND
I.F. AMPL.
1ST
L4
V3
6CB6
FRONT
V5
6CB6
V6
6CB6
V7
6CB6
FLAT AMPL.
R71
SENSITIVITY
FRONT
V2
6CB6
L3
MIXER
V1
6AH6
FRONT

FIGURE 8

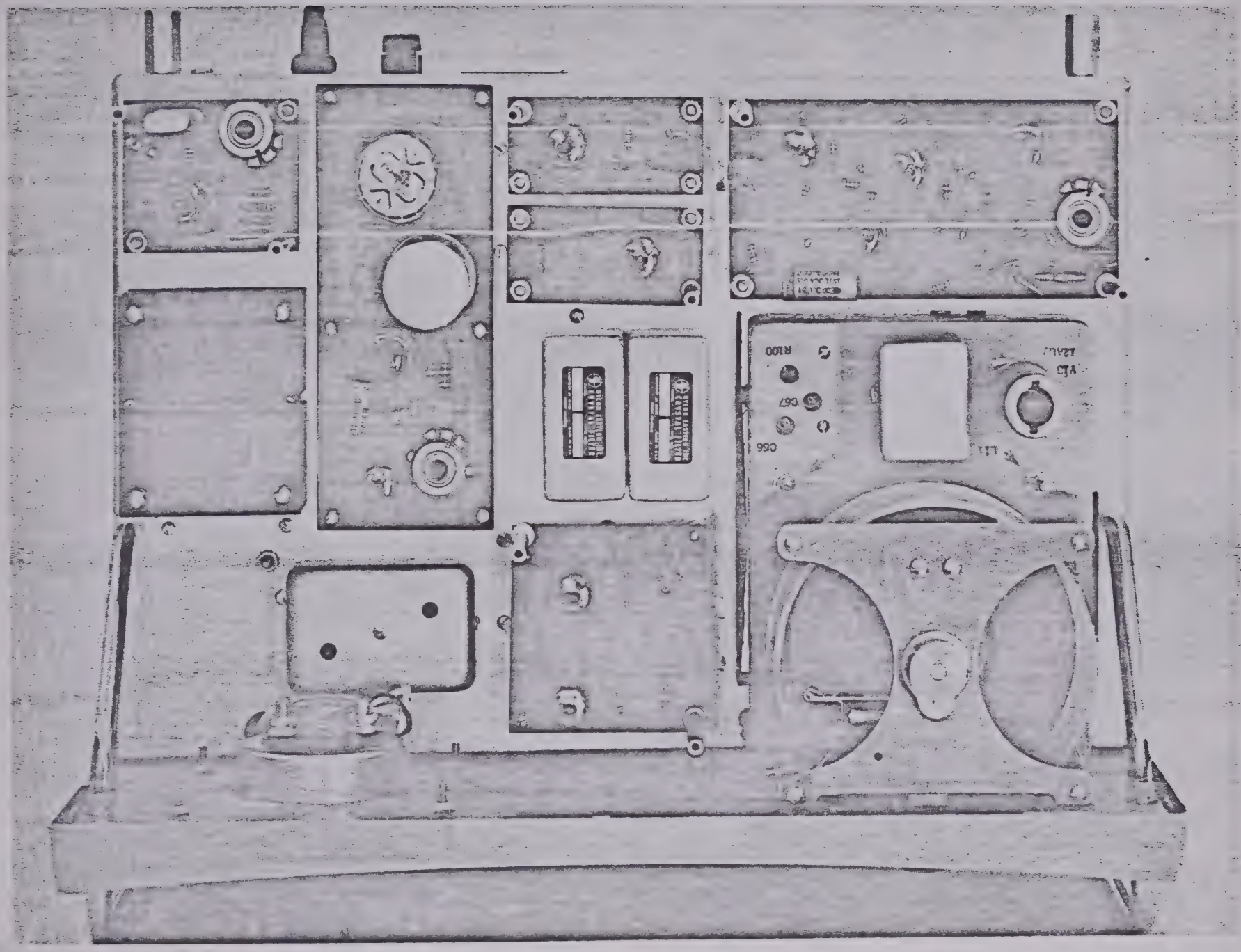
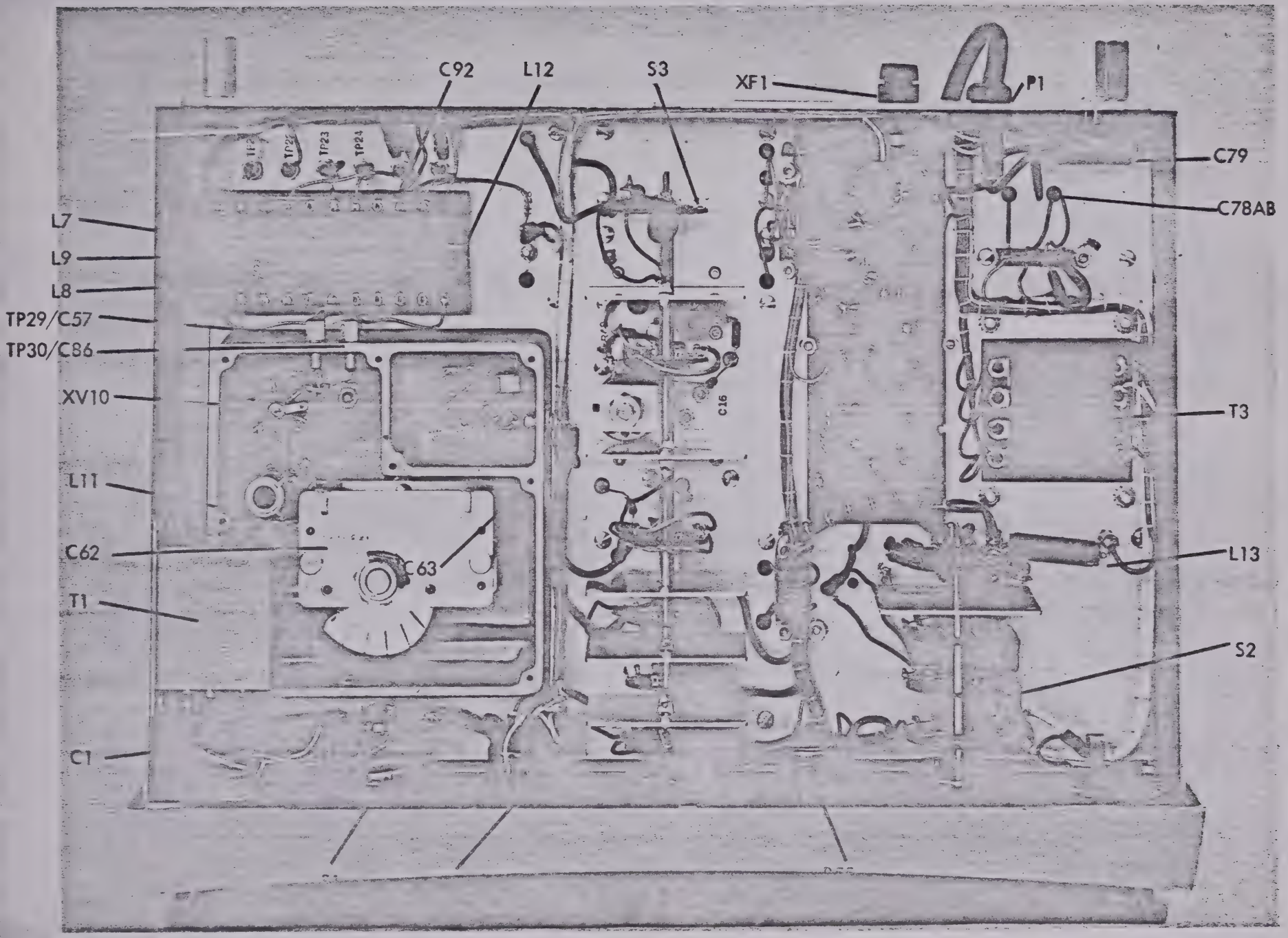


FIGURE 9

FIGURE 10

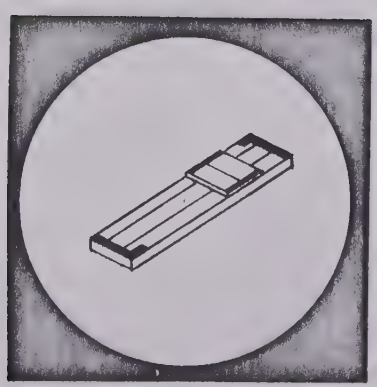

C92
L12
S3
XF1
P1
C79
C78AB
L7
L9
L8
TP29/C57
TP30/C86
XV10
T3
L11
C62
C63
L13
T1
S2
C1
TP22
TP23
TP24
C16

8.0 SUNDRY DATA

Bels, Decibels and Nepers.

Color Codes .

Short form catalog .



BELS , DECIBELS and NEPERS

The common logarithm of the ratio of two powers defines a number which is expressed in bels. The commonly used unit is the decibel , which is one tenth of the bel.

The number of decibels difference in level between V_1 volts and V_2 volts is

$$10 \log_{10} \frac{P_2}{P_1}$$

Since $$P = E \times I = E^2 / R$$

The ratio P_2 / P_1 is equal to E_2^2 / E_1^2 (R being constant)

So $$10 \log_{10} \frac{E_2^2}{E_1^2} = 20 \log_{10} \frac{E_2}{E_1}$$

The same applies to AC circuits providing that the voltages E_1 and E_2 are associated with equal impedances Z_1 and Z_2 . The decibel gain expression of two power magni--tudes is not affected by the impedances. Decibels refering to ratios, they may only be used as a measure of absolute magnitude when referred to reference level. There is no adopted reference standard and it is always necessary to state what reference level is being used. In the present instrument the practice is to use for reference level 1 milliwatt into 600 ohm (0.775 V).

The Neper : two powers P_1 and P_2 differ by N nepers when

$$N = \frac{1}{2} \log_{\epsilon} (P_1 P_2)$$

Thus the neper bears resemblance to the decibel, but differ in numerical value. The neper is based on Naperian logarithms to the base ϵ. To convert nepers to decibels, multiply by 8.686. To convert decibels to nepers, multiply by 0.1151 .

Decibels Expressed As Power And Voltage Ratios

Voltage Ratio	Power Rate (Ref. Level 1MW)	DB	Voltage Ratio	Power Ratio (Ref. Level 1MW)
1.000	1.000	0	1.000	1.000
.8913	.7943	1	1.122	1.259
.7943	.6310	2	1.259	1.585
.7079	.5012	3	1.413	1.995
.6310	.3981	4	1.585	2.512
.5623	.3162	5	1.778	3.162
.5012	.2512	6	1.995	3.981
.4467	.1995	7	2.239	5.012
.3981	.1585	8	2.512	6.310
.3548	.1259	9	2.818	7.943
.3162	.1000	10	3.162	10.000
.1778	.03162	15	5.623	31.62
.1000	.01	20	10.000	100.00
.056	.00316	25	17.78	316.2
.03162	.001	30	31.62	1,000
.010	.0001	40	100.00	10,000
.003162	.00001	50	316.2	100,000
.001	.000001	60	1,000	1,000,000
.000316	.0000001	70	3,162	10,000,000

NOTE: The power ratio columna give values which are equal to the number of milliwatts when the reference level is 1MW. The voltage ratio columns give values which are equal to the number of volts when the reference level is 1 volt.

INTERPOLATION: To find the power ratio corresponding to 43 db, or any other value not included in the table, proceed as follows:

a. Take the next lowest multiple of 40 db (in this case 40 db), and note the corresponding power ratio (in this case 100).

b. Take the difference between the specified level and the multiple of 20 db (in this case 23 - 20 = 3 db) and note the corresponding power ratio (in this case 1.995).

c. Multiply the two power ratios so determined

100 X 1.995 = 199.5

Decibels Above And Below Reference Level 1 mW Into 600 Ohms

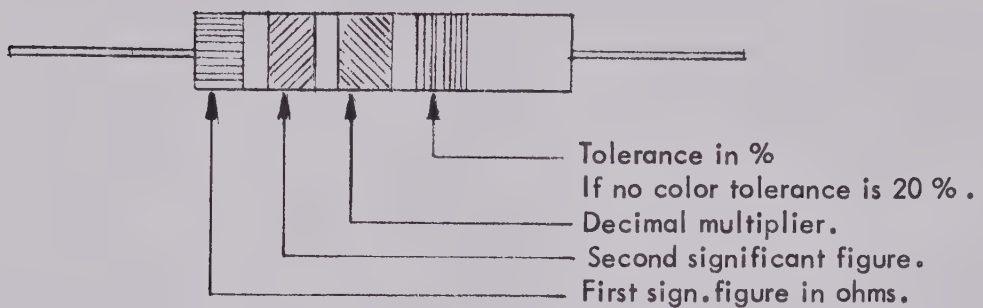
-db		Level	+ db	
Volts	Milliwatts	dbm	Volts	Milliwatts
0.774 6	1.000	0	0.774 6	1.000
0.690 5	.794 3	1	0.869 1	1.259
0.616 7	.631 0	2	0.975 2	1.585
0.548 4	.501 2	3	1.094	1.995
0.488 7	.398 1	4	1.228	2.512
0.435 6	.316 2	5	1.377	3.162
0.388 2	.251 2	6	1.546	3.981
0.346 0	.199 5	7	1.734	5.012
0.308 4	.158 5	8	1.946	6.310
0.274 8	.125 9	9	2.183	7.943
0.244 9	.100 0	10	2.449	10.000
0.218 3	.079 43	11	2.748	12.59
0.194 6	.063 10	12	3.084	15.85
0.173 4	.050 12	13	3.460	19.95
0.154 6	.039 81	14	3.882	25.12
0.137 7	.031 62	15	4.356	31.62
0.122 8	.025 12	16	4.887	39.81
0.109 4	.019 95	17	5.484	50.12
0.097 52	.015 85	18	6.153	63.10
0.086 91	.012 59	19	6.905	79.43
0.077 46	.010 00	20	7.746	100.00
0.043 56	.003 16	25	13.77	316.2
0.024 49	.001 00	30	24.49	1.000 watt
0.013 77	.000 316	35	43.56	3.162 watt
0.007 746	.000 100	40	77.46	10.00 watt
0.004 356	3.16×10^{-5}	45	137.7	31.62 watt
0.002 449	1.00×10^{-5}	50	244.9	100 watt
0.001 377	3.16×10^{-6}	55	435.6	316.2 watt
0.000 774 6	1.00×10^{-6}	60	774.6	1,000 watt
0.000 435 6	3.16×10^{-7}	65	1 ,377	3, 162 watt

COLOR CODES

General : Standardized color codes are used to mark values on components such as composition resistors, mica and paper molded capacitors, ceramic capacitors.

Fixed composition resistors :

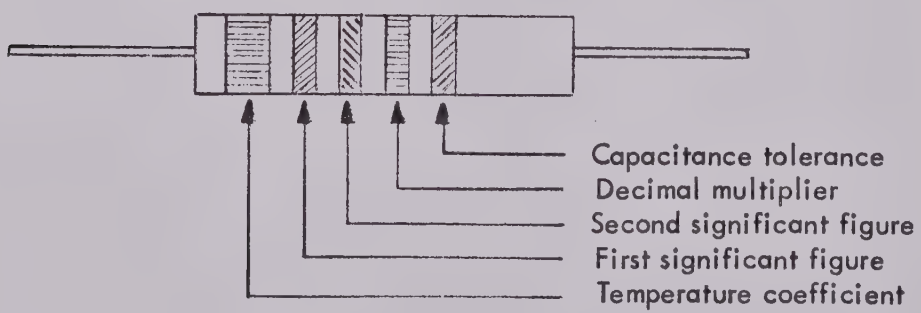
Insulated fixed composition resistors with axial leads are designated by a background of any color except black. The usual color is tan. Non insula--ted fixed resistors with axial leads are designated by a black background. The RETMA coding is as follows, (see chart of color code for code).



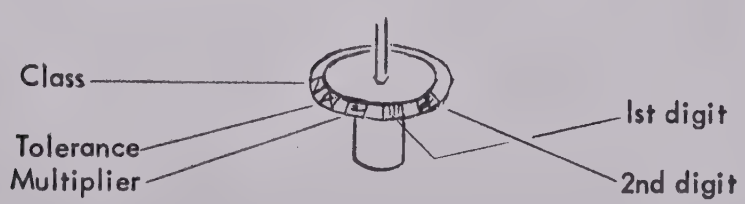
Fixed ceramic capacitors :

These capacitors are coded as indicated below , (see chart of color code for code).

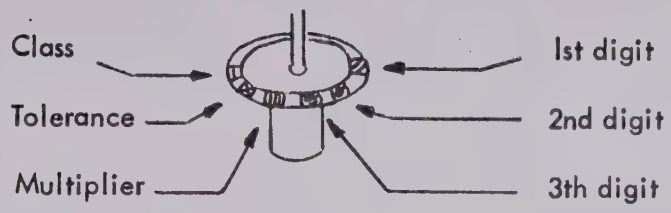
Axial leads ,



Button capacitors , 5 dot



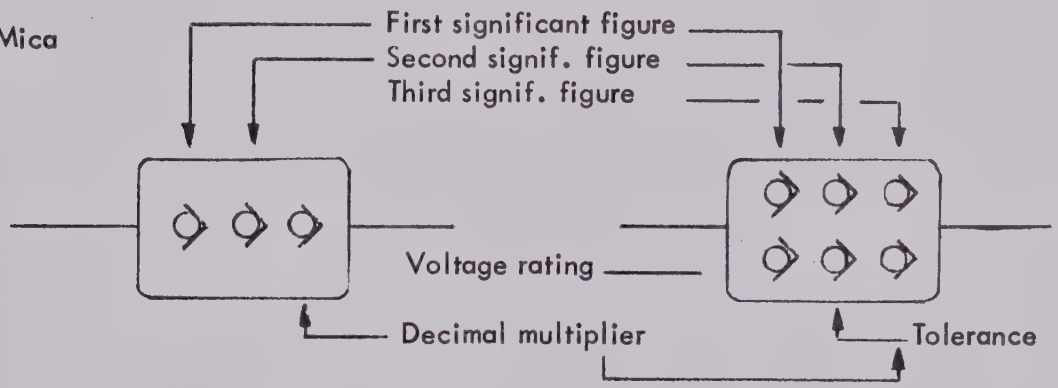
Button capacitors , 6-dot



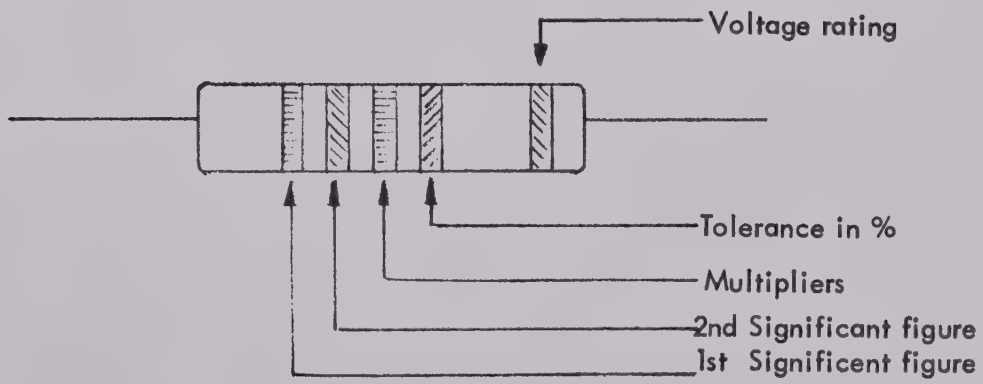
Molded capacitors :

The mica and molded paper capacitors are color coded according to two RETMA code . The 3-dot code is used for capacitors having a rating of 500 volts and 20 % tolerance. The 6-dot code cover all other ratings and tolerance.

Mica



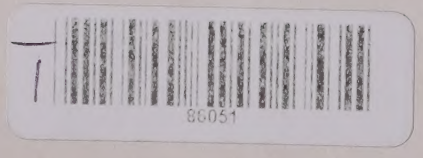
Paper tubular



Resistor - Capacitor Color Code

Color	Significant Figure	Decimal Multiplier	Tolerance	Voltage Rating
Black	0	1	-	-
Brown	1	10	1*	100
Red	2	100	2*	200
Orange	3	1,000	3*	300
Yellow	4	10,000	4*	400
Green	5	100,000	5*	500
Blue	6	1,000,000	6*	600
Violet	7	10,000,000	7*	700
Gray	8	100,000,000	8*	800
White	9	1,000,000,000	9*	900
Gold	-	0.1	5	1000
Silver	-	0.01	10	2000
No Color	-	-	20	500

* Applies To Capacitors Only.


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